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# BENZEDRINE IN CYCLOPLEGIA

## II. FURTHER REPORT

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This is the report of more definite data upon the use of benzedrine with cycloplegics in testing refraction, certain advantages of which were pointed out in an earlier communication.[1] This possibility had been suggested to us by a statement in a paper by Myerson and Thau[2] on the pharmacology of benzedrine, which claimed that complete but temporary cycloplegia follows its use with atropine in attenuated solutions. It would seem that the atropine inhibits the circular fibers of the ciliary muscle and the benzedrine stimulates the radial fibers. Thus an intense dilation of the muscle results, with corresponding relaxation of accommodation, but for a shorter time than when atropine is used again and again. We do not suppose that it is the presence of benzedrine that hastens the recovery, but rather the use of less atropine.

If this principle could be applied to the fitting of glasses it might, we thought, remove the most serious objections to cycloplegia for that purpose. Complaints are chiefly against the repeated instillations for cumulative effect, and the consequent protracted recovery. Tried in our clinics, the cycloplegia resulting from a single instillation each of benzedrine and atropine appeared essentially as complete as would be anticipated from a cumulative dosage of atropine alone, and of vastly shorter duration. We also found a similar action of benzedrine when associated with homatropine, the effect passing off with astonishing rapidity. Both seemed satisfactory for refraction. Our experiments also indicated a synergy with scopolamine and with euphthalmine.

Results were gauged by retinoscopy with the eye fixating at different distances, and, more certainly, by comparing static refraction at distance and near. With intelligent patients, amplitude was measured with a +3 D. sph. addition at 33 cm. With homatropine, the effect upon one eye of a single instillation followed by benzedrine was also compared with that upon the fellow eye, produced in the orthodox way by multiple administrations without benzedrine.

The present report compares the action of the two methods upon the same eye. Single instillations of the cycloplegics with benzedrine were used first, and the effect measured. When this had worn off, repeated doses without benzedrine were administered in the conventional manner.

### TECHNIQUE

We tried several methods, beginning with our regular office solutions. These are 1-percent atropine and 5-percent (not 2-percent) homatropine. The benzedrine (betaphenylisopropylamine or benzylmethylcarbamine) was a 1-percent aqueous solution of the sulphate.*

In our previous work, one of us had

* Furnished by courtesy of the manufacturers, Smith, Kline, and French Company, Philadelphia.

used benzedrine first, the other had used it after the cycloplegic. The results seemed identical, but, because patients mentioned tasting the benzedrine almost instantly, we suspected that it dilates the tear passage by adrenalinlike action. As this might facilitate the escape of the cycloplegic, and also because the action of benzedrine is fast, we decided to use it last, three or four minutes after the cycloplegic, and have done so in most of the cases presented in this report. There has never been the slightest toxic effect from the benzedrine.

## Results

Cycloplegia from benzedrine-homatropine is rapid. Often it is well along in 20 to 30 minutes, and at its peak in 50 to 70 minutes. The fall begins soon, so that the examination should be under way within the hour. The recovery progresses so rapidly that afternoon patients have claimed that they were able to read at seven or nine in the evening, and many by eleven. They can usually return to work the next morning. Atropine-benzedrine is also apt to reach its height in an hour, but a small increase may continue for half or three quarters of an hour longer. Following its administration, patients have read in one day, but ordinarily require two to four days.

## Material

Many patients in our clinics were incapable of the fine discrimination needed for this study. Fortunately Miss Virginia Dudley of the State Bureau of Social Welfare, and Mrs. Katherine M. Dougherty of the Cumberland County Public Health Association became interested in obtaining this unusually thorough examination for their patients. Their following is from intelligent country stock, subjects who coöperate well, and with these as laboratory material we were enabled to verify our retinoscopy by trial-case tests. Our figures are confined to data from such patients. There is nothing remarkable about age levels or types of error. A majority of the patients who were given atropine were from 8 to 11 years old; of those given homatropine the ages ranged from 15 to 19 years, with scattered cases over and under these limits. The majority needed corrections of less than +4. D. sph.; about half of these being under 1. D. sph. Neither these, nor errors of +8. D. sph., nor those indicating considerable myopia, nor the variations in age, showed any consistent relation to the results obtained.

The figures in the tables are subject to the inexactness affecting all data upon cycloplegia, although they were obtained under rather favorable conditions. Many variables influence comparisons of the efficiency of different drugs in controlling the ciliary muscle. Age, physical condition, previous use of cycloplegics, and wearing of correction may modify the results, but, unfortunately, without uniformity. It is difficult to conceive of any satisfactory means of equalizing such observations. Moreover, wavering of attention is a mischievous source of error in estimation of depth of cycloplegia. Measurement of residual accommodation, both at the trial case and with the retinoscope, presupposes concentration of gaze at a fixed distance. This is most difficult to secure in children, for whom these studies are especially designed. Infinite patience is needed for even approximate accuracy.

Yet it may probably be assumed that in the long run the errors more or less neutralize each other, so that, in general, the trend is fairly indicated. There is one exception. In nearly all cases, it was convenient to use the benzedrine method first. This may have given some advantage to the conventional cycloplegia which followed.

Values are computed by rating a cylin-

der as one half the worth of a sphere of the same number; thus, a 0.75 D. cylinder offsets a 0.37 D. sphere. This is analogous to using a cross cylinder, and of course has the same effect upon both methods.

TABLE 1

DEPTH OF CYCLOPLEGIA FOLLOWING CONVENTIONAL USE OF HOMATROPINE COMPARED WITH THAT INDUCED BY THE BENZEDRINE METHOD

| Gain | | No change | Loss | |
|---|---|---|---|---|
| Diopters | Cases | Cases | Diopters | Cases |
| +.75 | 1 | 7 | −.50 | 2 |
| +.50 | 1 | | −.25 | 4 |
| +.37 | 1 | | −.12 | 1 |
| +.25 | 3 | | | |
| +.12 | 5 | | | |

Average gain by use of conventional homatropine 0.035 diopter.

TABLE 2

DEPTH OF CYCLOPLEGIA FOLLOWING CONVENTIONAL USE OF ATROPINE COMPARED WITH THAT PREVIOUSLY INDUCED BY THE BENZEDRINE METHOD

| Gain | | No change | Loss | |
|---|---|---|---|---|
| Diopters | Cases | Cases | Diopters | Cases |
| +.75 | 1 | 4 | −.87 | 1 |
| +.62 | 2 | | −.25 | 2 |
| +.50 | 6 | | | |
| +.37 | 2 | | | |
| +.25 | 6 | | | |
| +.12 | 3 | | | |

Average gain by use of conventional atropine 0.23 diopter.

Offhand, the predominance of small plus shifts in the atropine group and the rather noncommittal homatropine figures suggest that the cumulative use of atropine is likely to abolish about .25 D. more activity of the ciliary muscle than benzedrine-atropine, but that with homatropine there is little to choose. This, of course, conforms to the common experience, confirmed by Bothman in the preceding paper,[3] that prolonged atropinization gives the utmost relaxation, while homatropine is less reliable. We are not yet ready, however, for a final decision. Moreover, for several reasons, accuracy to .25 D. is not to be expected in a study of cycloplegia. The error due to irregularities in the media uncovered by mydriasis affects the precision of retinoscopy and of subjective tests. Probably most disturbing is the variation in instillation. It is a precarious method of drugging, owing to the activity of the lids and to tears. With the benzedrine method where everything hangs on one drop, this adds to the difficulty of obtaining uniform administration. Multiple dosage has the advantage that the more drops that are instilled, the greater is the chance that one will be effective.

### MODIFICATIONS OF TECHNIQUE

Because the first drop of cycloplegic is so often flicked, squeezed, or washed out of a hypersensitive eye, we recently have used a second drop following the benzedrine, spacing the instillations about two minutes apart. The slight anesthetic property of the benzedrine seems to make subsequent instillations better tolerated. The addition of the second drop does not increase the depth of cycloplegia but seems to cause the peak to be held a little longer without appreciably protracting recovery. This is to be distinguished from the repetition of the cycloplegic instillation or of the entire treatment at the end of an hour, which we used sometimes to employ when accommodation seemed to persist, and which was often followed, in the case of atropine, by a measureable increase in effect. Of course, this would have been likely to follow without the extra drop, so we abandoned the practice, deeming it unnecessary. Also because in the case of homatropine, inconsistently, the effect was as apt to diminish, even when we proceeded to use six more drops of homatropine in the conventional way. Homatropine with benzedrine yields promptly to eserine.

We have experimented with several

other methods of administration. To avoid the rare reaction in sensitive patients to even a single drop of atropine, we have been trying higher dilutions. Our experience is too slight to report, but we find solutions of 1 :500, both of atropine and of benzedrine, worthy of further study. In some instances it has seemed possible to intensify the cycloplegia following prolonged atropinization at home, by instilling also atropine and benzedrine one-half hour before examination. This may turn out to be a powerful method of inducing cycloplegia. Satisfactory cycloplegia also follows the repeated use of benzedrine mixed with homatropine, six doses in an hour, after the analogy of cocaine and homatropine. It is less irritating to the cornea and does not require an hour and a half of closed eyes to prevent exfoliation, but the recovery is slow.

It is imperative in using the benzedrine method to make certain of proper instillation of the cycloplegic. Benzedrine itself is so potent that a minute drop in contact with the cornea seems adequate. In using the cycloplegic, however, whether but once or both before and after the benzedrine, we try to avoid loss by placing the head so as to incline the cornea toward the horizontal, and by controlling the lids to prevent squeezing or snapping it out. Too much should not be expected of a single drop unless it is properly instilled.

*To assure effective instillation, we favor use of the cycloplegic, either 5-percent homatropine or 1-percent atropine, followed in two or three minutes by an instillation of 1-percent benzedrine; then, allowing a couple of minutes for this to take effect, a second instillation of the cycloplegic.*

## Conclusion

The benzedrine method has, with us, had a special field of usefulness in the care of out-of-town patients, and in the clinic. When time is short the action is quick. No potent drugs need be placed in the hands of incompetent parents. Systemic effect causes no anxiety. Cycloplegia is possible when a second visit cannot be made for examination, and when students and adults must return immediately to work. Patients enthusiastically welcome the freedom from annoyance, and the rapid recovery. If results should be uncertain, the routine method can still be employed.

At present it is our opinion that in critical cases prolonged atropinization is probably justified to compel utmost reaction, although it is not so reliable as it is generally believed to be. In general, the gain over the benzedrine method is so slight and uncertain that it is doubtful whether it often compensates for the loss of time.

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## References

[1] Beach and McAdams. Benzedrine in refraction. Preliminary report. Trans. Amer. Ophth. Soc., 1937 (in press).

[2] Myerson and Thau. Human autonomic pharmacology: IX. Arch. of Ophth., 1937, v. 18, no. 1, p. 87.

[3] Bothman. Refractive errors in the same eyes while under the effects of homatropine, scopolamine, and atropine. Trans. Amer. Acad. Ophth. and Otolaryn (in press).

# OPTICAL DECENTRATION OF THE EYE*

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The words decentration of the optical system of the eye refer to the angle lying between the optical axis and the visual line. Helmholtz named it angle alpha ($\alpha$), Donders ($\gamma$), and finally, Landolt named it angle kappa ($\varkappa$).

The measurement of this angle is very important for the definition of the possible effect when operating for squint and for the solution of a series of questions pertaining to the localization of foreign bodies, detachments of the retina, intraocular cysticercus, and other alterations in the fundus.

The methods proposed by Helmholtz, Donders, Mautner, and others, were complicated and difficult. Our new method is based on a double localization of the light reflex on the cornea, using a perimeter. The patient must fix his gaze on the central point of the perimeter. The investigator moves his eye from the center to the periphery along the back of the perimeter arc. In front of this arc is placed a miniature electric lamp; its light does not strike the eye of the investigator (fig. 1).

When the investigator moves the lamp his eye always remains on a straight line connecting the lamp with the nodal point of the patient's eye. He watches the movement on the cornea of the reflex from the lamp. When the light reflex approaches the corneal limbus and meets the scleral area with a different radius it disappears. The observer reads the position of the electric lamp in degrees on the perimeter arc. This determination is made at the nasal and temporal corneal borders. Generally these two readings are not equal; the half of their difference represents the value of angle kappa ($\varkappa$); when both

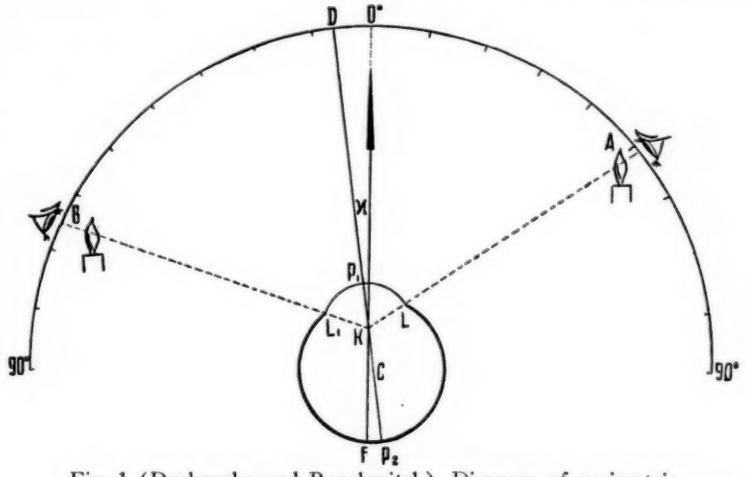


Fig. 1 (Dashevsky and Booshmitch). Diagram of perimetric method of measuring the angle kappa.

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readings are equal angle kappa is zero.

We used this method and others on a large number of people and found the error in our method to be not more than 0.5° to 1°.

The literature on the decentration of the eye gives very little or no precise information concerning the plane in which angle kappa is located. Helmhotz, Donders, Landolt, and other authors have said that this angle is located approximately in the horizontal section of the eyeball. To determine whether the plane of angle kappa really coincides with the horizontal plane or forms with it a certain angle, which we provisionally name angle delta (δ), we made a series of investigations. When we made an estimate of angle kappa and placed the perimeter arc on the horizontal meridian it was observed that the light reflex did not move through the center of the cornea and that its direction was not through the horizontal corneal diameter but above and below it; that is, it passed along the chord and the projection of the cornea on the plane. Therefore we surmised that the visual line passed through the cornea not only horizontally with respect to its geometric center but also above or below the horizontal corneal diameter.

In figure 2, the circle represents the cornea; C is its anatomical center, generally known as the anterior pole of the eyeball; consequently, the anterior end of its optical axis. The point O is the point on the cornea through which the visual line passes. Obviously, the line M N is the direction of the movement of the

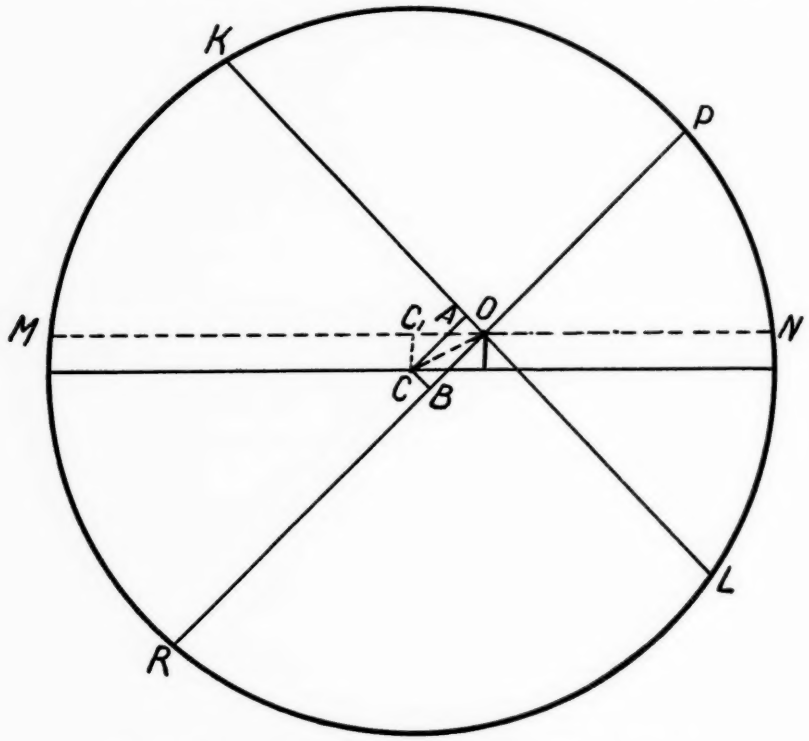


Fig. 2 (Dashevsky and Booshmitch). Diagram illustrating the method for determining the angle delta.

light reflex when the investigation is made by the aforementioned method.

The angle kappa corresponds to the arc O C, which appears on our sketch in the form of a straight line because in this experiment we are studying the cornea as if it were lying on a plane.

When, by our method, we measure the angle kappa, we are in reality measuring the size of the arc O $C_1$, which decidedly will be a little smaller than the arc O C, which corresponds to the real angle kappa. To define the size of the arc O C we altered our method and instead of measuring the angle kappa at the horizontal position of the perimeter arc, we made measurements on two meridians located at an angle of 45° with respect to the horizontal line.

When measuring on the meridian P R we evaluated the angle kappa, which corresponds to the size of the arc O B. On the meridian K L the angle kappa corresponds to the size of the arc A O. But, neither of these two angles represents the real angle kappa. A O and O B represent the sides of a rectangular square of which O C is a diagonal. Using the two values A O and O B we determine the value of the real angle kappa O K — O L = 2 A O; O R — O P = 2OB; A O = B C; $\frac{BC}{OB} = \frac{AO}{OB} = \tan \angle B\,O\,C = \tan (45° - \delta)$. What is angle B O C? Angle M O B equals 45 degrees. Angle M O C is the angle delta ($\delta$). Hence it is obvious that the angle B O C = 45° minus the angle delta = 45 — $\delta$. Therefore, if we divide one of these values by the other we will have the tangent of the angle (45° — $\delta$). Using mathematical tables we easily find the value of the angle delta ($\delta$).

Now it is also easy to determine the value of the real angle kappa by using the formula: $\varkappa_\delta = \frac{OB}{Cs\,(45° - \delta)}$

In this way, by measuring by our method the angle delta on two meridians located at 45 degrees to the horizontal, we shall define not only the angle delta but also the real value of angle kappa, which as yet could not be defined by any of the existing methods; nor by means of our method when the angle kappa is measured on the horizontal meridian of the eyeball.

To find out to what extent the size of the angle changes if the measurement is made on the horizontal meridian by our method, or if this is done in the same manner as when determining the angle delta ($\delta$) and the real angle kappa ($\varkappa$), we used the following formula:

O C = O C · cos$\delta$ or $\varkappa_{hor} = \varkappa_\delta \cdot \cos\delta$

With this formula we obtained good results. We could define the value of the real angle kappa, of the angle $\delta$, at which the plane of the angle kappa is inclined to the plane of the horizontal meridian, and also ascertain to what extent the value of the angle $\varkappa_{hor}$, reckoned by our method on the horizontal meridian, differs from the real value of the angle $\varkappa_\delta$. We could also again prove the degree of error when our method is used.

By means of the aforementioned formulas we worked out a table which permits us to define easily at once in degrees the size of the angles $\delta$, $\varkappa_\delta$, $\varkappa_{hor}$. Table 1 shows the values of these angles for the values of O B and O A from 1 degree to 8 degrees. The numbers in the squares under the line show the values of the angle delta ($\delta$); the numbers above the line show the values of the angle $\varkappa_\delta$ (without parentheses) and of the angle $\varkappa_{hor}$ (in parentheses).

Explanation. Let us suppose that when measuring the angle kappa of the right eye, by the method of a double localization of the light reflex, we obtained the following values: angle kappa on the horizontal meridian = 4°; on the oblique meridians at an angle of 45 degrees to

TABLE 1

THE SIZE OF THE ANGLES $\delta$, $\varkappa_\delta$, AND $\varkappa_{HOR}$ FOR VALUES OF O B AND O A FROM 1° TO 8°

| O A \ O B | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.4°(1.4°)<br>0° | 2.2°(2.1°)<br>18.3° | 3.7°(3.3°)<br>26.6° | 4.1°(3.5°)<br>31.0° | 5.1°(4.2°)<br>33.7° | 6.1°(5.0°)<br>35.5° | 7.1°(5.7°)<br>36.9° | 8.1°(6.4°)<br>37.9° |
| 2 | 1.1°(1.0°)<br>−18.3° | 2.8°(2.8°)<br>0° | 3.7°(3.6°)<br>11.3° | 4.5°(4.1°)<br>18.3° | 5 4°(5.0°)<br>23.2° | 6.2°(5.5°)<br>26.6° | 7.3°(6.4°)<br>29.0° | 8.3°(7.1°)<br>31.0° |
| 3 | 1.1°(1.0°)<br>−26.6° | 2.4°(2.4°)<br>−11.3° | 4.2°(4.2°)<br>0° | 5.0°(5 0°)<br>8.2° | 5.8°(5.6°)<br>14.0° | 6 7°(6.4°)<br>18.3° | 7.6°(7.1°)<br>21.8° | 8.5°(7.7°)<br>24.5° |
| 4 | 1.0°(0.9°)<br>−31.0° | 2.2°(2.1°)<br>−18.3° | 3.7°(3.7°)<br>−8.2° | 5.7°(5.7°)<br>0° | 6.4°(6.3°)<br>6.3° | 7.2°(7.1°)<br>11.3° | 8.1°(7.8°)<br>15.2° | 9.0°(8.1°)<br>18.3° |
| 5 | 1.0°(0.8°)<br>−33.7° | 2.1°(1.9°)<br>−23.2° | 3.5°(3.4°)<br>−14.0° | 5.1°(5.1°)<br>−6.3° | 7.1°(7.1°)<br>0° | 7.8°(7.7°)<br>5.2° | 8.6°(8.5°)<br>9.5° | 9.4°(9.3°)<br>13.0° |
| 6 | 1.0°(0.8°)<br>−35.5° | 2.1°(1.9°)<br>−26.6° | 3.4°(3.2°)<br>−18.3° | 4.8°(4.7°)<br>−11.3° | 6.6°(6.6°)<br>−5.2° | 8.5°(8.5°)<br>0° | 9.2°(9.2°)<br>4.3° | 10°(9.9°)<br>8.3° |
| 7 | 1.0°(0.8°)<br>−36.9° | 2.1°(1.8°)<br>−29.0° | 3.3°(3.1°)<br>−21.8° | 4.6°(4.5°)<br>−15.2° | 6.1°(6.0°)<br>−9.5° | 7.9°(7.9°)<br>4.3° | 9.9°(9.9°)<br>0° | 10.6°(10.5°)<br>3.8° |
| 8 | 1.0°(0.8°)<br>−37.9° | 2.1°(1.8°)<br>−31.0° | 3.2°(3.0°)<br>−24.5° | 4.5°(4.1°)<br>−18.3° | 5.9°(5.8°)<br>−13.0° | 7.5°(7.1°)<br>−8.2° | 9.3°(9.3°)<br>−3.8° | 11.3°(11.3°)<br>0° |

NOTE: Value of the angle delta is given below the line in the square; for $\varkappa_\delta$ above the line; and for $\varkappa_{hor}$ also above the line in parentheses.

the horizontal O A = 1°, O B = 5°.

Referring to table 1 we find: angle $\delta$ = 33.7° (or 34°); $\varkappa_\delta$ = 5.1; $\varkappa_{hor}$ = 4.2°.

With this table we elaborated the data obtained from the examination of 100 eyes (see table 2).

Table 2 shows the values:

1. Of the angle $\delta$ (the incline of the plane of the decentration angle to the horizontal plane.

2. Of $\varkappa_\delta$, the real angle kappa measured for the first time in the history of ophthalmological optics.

3. Of $\varkappa_{hor}$, the value of angle kappa for the horizontal plane reckoned by the aforementioned formula ($\varkappa_{hor} = \varkappa_\delta \cdot \cos\delta$), after measuring on two oblique meridians.

4. Of $\varkappa$, the decentration angle defined by direct measurement on the horizontal plane by the method of double localization.

The results obtained are very interesting as regards the definition of the angle delta; that is, of the plane's incline of the angle $\varkappa_\delta$ and of the degree of the possible error when using our method. In the 100 eyes examined, the value of the angle delta did not exceed 35 degrees, but the variations of the size of this angle were very interesting: in 61 percent the angle delta did not exceed 10 degrees; in 35 percent it was larger, and in only four eyes was the angle delta larger than 25 degrees and less than 35 degrees. Hence one may conclude that the angle kappa does not lie precisely in the horizontal plane and that the incline of its plane, as a rule, does not exceed 25 degrees. Between these limits

TABLE 2

THE VALUES OF THE ANGLES $\delta$, $\varkappa_\delta$, $\varkappa_{HOR}$, AND $\varkappa$ IN 100 EYES

| No. | $\delta$ | $\varkappa_\delta$ | $\varkappa_{hor}$ | $\varkappa$ | No. | $\delta$ | $\varkappa_\delta$ | $\varkappa_{hor}$ | $\varkappa$ | No. | $\delta$ | $\varkappa_\delta$ | $\varkappa_{hor}$ | $\varkappa$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | +16.0° | 5.2° | 4.6° | 5.0° | 35 | − 0.0° | 1.8° | 1.7° | 1.0° | 69 | +14.0° | 5.8° | 5.6° | 4.5° |
| 2 | + 4.0° | 5.4° | 5.4° | 5.0° | 36 | 0° | 1.8° | 1.7° | 1.5° | 70 | + 8.0° | 5.0° | 5.0° | 4.5° |
| 3 | +34° | 5.1° | 4.2° | 4.0° | 37 | +18° | 1.8° | 1.7° | 2.5° | 71 | + 3.0° | 7.4° | 7.4° | 6.0° |
| 4 | + 4.0° | 5.4° | 5.4° | 5.0° | 38 | + 9.0° | 2.5° | 2.5° | 3.0° | 72 | + 3.0° | 6.7° | 6.6° | 5.5° |
| 5 | +25° | 4.2° | 3.8° | 4.0° | 39 | −11° | 1.2° | 1.2° | 1.0° | 73 | 0° | 7.1° | 7.1° | 7.5° |
| 6 | +21° | 5.0° | 4.5° | 4.0° | 40 | −18° | 1.4° | 1.4° | 1.5° | 74 | +13.9° | 4.7° | 4.5° | 4.5° |
| 7 | + 6.0° | 4.0° | 3.9° | 3.0° | 41 | + 5.0° | 3.5° | 3.4° | 5.5° | 75 | +14° | 5.8° | 5.6° | 5.5° |
| 8 | + 4.0° | 4.7° | 4.7° | 3.0° | 42 | +22° | 3.0° | 3.0° | 4.0° | 76 | +20° | 7.1° | 6.7° | 7.0° |
| 9 | + 3.0° | 3.6° | 3.6° | 5.0° | 43 | +30° | 5.4° | 5.0° | 4.0° | 77 | −13° | 3.0° | 2.9° | 2.5° |
| 10 | +16° | 5.2° | 4.9° | 5.0° | 44 | +35° | 6.1° | 5.0° | 2.0° | 78 | 0° | 2.8° | 2.8° | 2.0° |
| 11 | − 8.0° | 3.7° | 3.7° | 5.0° | 45 | 0° | 4.6° | 4.4° | 3.5° | 79 | − 5.2° | 6.6° | 6.6° | 8.5° |
| 12 | + 6.0° | 4.0° | 3.9° | 5.0° | 46 | 0° | 4.2° | 4.2° | 3.5° | 80 | − 8.2° | 3.7° | 3.7° | 4.5° |
| 13 | +10° | 6.7° | 6.7° | 5.0° | 47 | +18° | 5.6° | 5.3° | 5.0° | 81 | + 5.0° | 7.8° | 7.8° | 5.0° |
| 14 | + 6.0° | 7.1° | 7.0° | 5.0° | 48 | +23° | 5.4° | 5.0° | 3.0° | 82 | + 3.0° | 6.7° | 6.6° | 5.0° |
| 15 | 0° | 4.7° | 4.7° | 4.0° | 49 | +23° | 5.4° | 5.0° | 4.0° | 83 | + 4.4° | 4.6° | 4.6° | 3.5° |
| 16 | 0° | 5.7° | 5.7° | 4.0° | 50 | + 8.0° | 5.0° | 5.0° | 4.0° | 84 | +14° | 5.8° | 5.6° | 5.0° |
| 17 | − 4.0° | 4.0° | 4.0° | 3.5° | 51 | +14° | 5.8° | 5.6° | 4.0° | 85 | + 5.2° | 7.8° | 7.8° | 6.0° |
| 18 | + 4.0° | 4.0° | 4.0° | 3.0° | 52 | + 9.0° | 4.2° | 4.2° | 4.0° | 86 | + 8.8° | 6.8° | 6.7° | 5.5° |
| 19 | 0° | 6.7° | 6.4° | 6.0° | 53 | +15° | 4.2° | 3.9° | 5.5° | 87 | + 6.3° | 6.4° | 6.3° | 5.0° |
| 20 | 0° | 5.4° | 5.0° | 5.0° | 54 | +22° | 3.0° | 2.7° | 2.0° | 88 | + 7.0° | 8.2° | 8.1° | 7.0° |
| 21 | 0° | 2.8° | 2.8° | 3.0° | 55 | +10° | 6.1° | 5.9° | 3.0° | 89 | + 6.3° | 6.4° | 6.3° | 5.5° |
| 22 | +19° | 3.7° | 3.5° | 3.0° | 56 | +17° | 5.6° | 5.3° | 4.0° | 90 | + 3.0° | 6.7° | 6.7° | 5.5° |
| 23 | −11° | 2.4° | 2.4° | 3.5° | 57 | + 9.5° | 8.6° | 8.5° | 7.0° | 91 | + 6.3° | 6.4° | 6.3° | 5.0° |
| 24 | +21° | 5.0° | 4.5° | 5.0° | 58 | 0° | 2.8° | 2.8° | 4.0° | 92 | + 5.0° | 7.8° | 7.8° | 5.0° |
| 25 | 0° | 1.8° | 1.8° | 1.0° | 59 | + 3.0° | 5.4° | 5.4° | 5.5° | 93 | + 5.0° | 7.8° | 7.8° | 6.0° |
| 26 | 0° | 1.4° | 1.4° | 1.0° | 60 | + 8.0° | 5.0° | 5.0° | 3.5° | 94 | + 8.0° | 5.0° | 5.0° | 4.5° |
| 27 | +23° | 5.8° | 5.6° | 6.0° | 61 | +11.3° | 7.2° | 7.1° | 6.5° | 95 | + 6.0° | 6.4° | 6.3° | 5.0° |
| 28 | +25° | 5.6° | 5.3° | 4.0° | 62 | +18.6° | 5.6° | 5.3° | 4.0° | 96 | +18° | 4.5° | 4.1° | 3.5° |
| 29 | +12° | 8.3° | 8.1° | 6.0° | 63 | + 3.0° | 6.7° | 6.7° | 9.0° | 97 | + 4.0° | 9.2° | 9.2° | 8.0° |
| 30 | +19° | 3.7° | 3.5° | 2.0° | 64 | +11° | 5.4° | 5.3° | 4.0° | 98 | + 6.0° | 6.4° | 6.3° | 5.5° |
| 31 | + 9.0° | 2.6° | 2.5° | 2.0° | 65 | +18.6° | 5 6° | 5.3° | 5.0° | 99 | + 8.8° | 6.7° | 6.7° | 6.0° |
| 32 | −26° | 1.8° | 1.7° | 1.0° | 66 | +20.7° | 4.9° | 4.5° | 3.5° | 100 | +23.2° | 5.4° | 5.0° | 4.0° |
| 33 | + 6.0° | 4.0° | 3.9° | 2.5° | 67 | + 4.0° | 5.3° | 5.3° | 4.5° | | | | | |
| 34 | − 6.0° | 3.3° | 3.2° | 2.5° | 68 | + 4.0° | 5.3° | 5.3° | 4.0° | | | | | |

one may meet a number of variations.

We attempted to determine in what degree the value of the angle kappa for a horizontal plane, measured mathematically, differs from the real angle kappa ($\varkappa_\delta$). With the data from 100 eyes we determined the distance between the real angle kappa and the angle kappa in the horizontal plane, and taking this difference as a variant we elaborated the method by the aid of variational statistics.

We found that this value varies with a certain regularity.

The average value of the real angle kappa minus angle $\varkappa_{hor}$:

$M \pm m = 0.144° \pm 0.018°$; $\sigma = \pm 0.18°$

These values are so minute that we find it unnecessary to complicate the methods of the definition of the angle kappa with additional determinations on two oblique meridians. The greater precision that may be obtained will not exceed the average error of our method. We must add that our method also appears not to be perfectly exact; it is however, sufficiently accurate for ophthalmological practice. As regards the maximum exact measurement of the angle lying between the visual line and the optic axis, and of the incline of its plane to the plane of the horizontal meridian (angle $\delta$) we wish to emphasize that our method approaches most nearly to exactness. We also compared the value of the angle kappa for the horizontal meridian reckoned by the formula $\varkappa_{hor} = \varkappa_\delta \cdot \cos\delta$, with the value of this angle obtained by direct measurement on the horizontal meridian for each of the

100 eyes examined. In this manner we proved our method of double localization, taking measurements on the horizontal and on two oblique meridians at an angle of 45 degrees to the horizontal plane. The difference between the values of the angle kappa obtained by the same method but by two means, appeared to be trifling.

Elaborating the data by the method of variational statistics we obtained the following results: $M \pm m = 0.61° \pm 0.1°$; $\sigma \pm 1.0°$.

Thus we may conclude that:

1. The angle kappa does not lie precisely in the horizontal plane.
2. The angle of the plane's incline of the angle kappa to the horizontal does not exceed 25 degrees.
3. The measurement of the angle kappa by our method of a double localization of the light reflex appears to be the most precise of all proposed methods.
4. In most cases the visual line passes through the cornea inwards and upwards from the corneal center.
5. The slight degree of error in our method permits its application for clinical practice and theoretical use and appears to be the smallest as regards the other methods.

*5 Pravda Street.*

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# NEUROMYELITIS OPTICA*

## A REPORT OF TWO CASES

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Neuromyelitis optica is an acute or subacute myelitis associated with bilateral changes in the optic nerve.

In 1870, Clifford Allbutt[1] reported upon a series of cases of myelitis, traumatic and from other causes, among which were five cases of acute myelitis. In one of these "sympathetic disorder of the eye came on many weeks, 12 or 13 at least, after the subsidence of the acuter symptoms." Allbutt concluded that "changes at the back of the eye do not infrequently follow spinal disease." This observation was soon followed by a number of similar reports, and in 1889 Achard and Guinon[2] published a clinicopathologic study of this newly described condition. Devic,[3] who first used the term "neuromyelitis optica," in 1894 summarized the reported cases in his Thèse de Lyon, and since that time this disease entity has often been referred to as "Devic's syndrome." Twenty years later Goulden[4] was able to collect 52 reported cases, and in the same year Holden,[5] who had previously reported four cases, added a fifth, in which the spinal myelitis was complicated by complete blindness in one eye and almost complete blindness in the other, with subsequent restoration of useful vision in each. In 1927 Beck[6] reviewed 70 cases. Perritt[7] reported two cases in 1934. In 1935, Walsh[8] reported four cases with a pathological study of one, and in 1936, Balser[9] published a clinicopathologic study of three cases and a clinical report of a fourth.

In all, some 100 cases have been reported, although neuromyelitis optica is

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probably not so rare nor so fatal a condition as this number of reported cases might suggest. Balser believes that on analysis many of the cases prove to be multiple or diffuse sclerosis. Moreover, there are many observers in different countries who consider neuromyelitis optica a form of acute multiple sclerosis or acute encephalomyelitis, and will not maintain a rigid differentiation between the three groups (Brain[10]). The disturbances of vision are dramatic. They are bilateral, acute, and may progress rapidly until complete blindness ensues. They may precede or follow the myelitic process; however, in a number of reported cases they occurred simultaneously. The ophthalmoscopic signs may be negative at first, the dimness of vision being due to a retrobulbar neuritis, or there may be evidence of inflammatory changes on the disc. Later, optic atrophy may appear.

In Balser's case 1, the patient was totally blind and both optic discs were hyperemic, with blurring of the nasal edges. In Perritt's first case, a child of five years, examination revealed a bilateral papillitis with no perception nor projection of light in either eye.

The patient may complain of severe pain in the orbit, which increases on ocular movement or digital pressure. The two eyes may be involved simultaneously, or one eye may be affected, to be followed in a few days, or weeks by the involvement of the other eye. Blindness is usually complete and remains so for a variable time—from a few days to months. The interval between the onset of ocular symptoms and the development of myelitis varies from a few hours to many days.

Balser says "Neuromyelitis optica, as summarized from the cases herein reported, is characterized by an asymmetrical diffuse demyelination of the cord, brain stem, and optic nerves and tracts. From the study of early lesions in the optic tracts (serial sections in case 2), it appears that the lesions are perivascular and may be in the center of the tracts at first, and extend or coalesce so that there soon appears a central core of destruction of myelin sheaths and axis cylinders." Why these spinal and optic-nerve changes occur together has never been explained.

Visual-field defects include temporal hemianopsia, central scotoma, or central scotoma combined with concentric narrowing. The central scotoma may be absolute or relative, the color fields showing a defect for red and green.

The etiology of neuromyelitis optica is unknown. Syphilis, nephritis, alcoholism, and tuberculosis have all been suggested. In recent years there has been a tendency to group neuromyelitis optica with other diseases in which patchy demyelinization throughout the central nervous system occurs, particularly the acute and chronic forms of multiple sclerosis and encephalomyelitis, and to consider that these various clinical types are caused by unknown infectious agents. A neurotropic virus has been suggested as the infective agent, but up to the present time there has been no proof to confirm this, in spite of the many attempts to transfer these diseases to animals. In the opinion of other investigators the lesions are degenerative rather than inflammatory. Recently, Cone, Russel, and Harwood[11] have suggested that lead poisoning may be an important factor, and in their series report a typical case of neuromyelitis optica in which there was associated lead poisoning.

With so indefinite an etiology, one can understand how empiric treatment must be. Mercury, the iodides, salicylates, strychnine, and foreign protein have all been tried. If lead poisoning can be associated with any case, measures to induce lead storage (high calcium intake)

should be promptly used. Russell Brain[12] has stated that arsenic, either orally or intravenously, is contraindicated. Frequently drainage of the spinal fluid by lumber puncture has been advised by some, but Walsh says that lumber puncture may cause a rapid increase in symptoms and result in death.

With regard to prognosis, it has been estimated that recovery occurs in about 50 percent of the cases (Goulden). Vision usually, although not always, returns to normal or nearly normal, and the spinal symptoms recede. When it occurs, death is usually due to the upward extension of the myelitic process to involve the medullary centers, or to pulmonary and urinary-tract infection. Relapses have been reported, but are rare. This condition may occur at any time from childhood to middle life.

## Case reports

*Case 1.* H. D. S., an adult male of 34 years, was brought into the consulting room of one of us (S. H. M.) on February 21, 1936, complaining that he had suddenly become blind three days previously; that his eyes were painful, and that this pain was aggravated by movements of his eyes. Examination showed that his eyes were free from inflammation, and his pupils widely and evenly dilated. He stated very definitely that he had not put any drops recently in his eyes. The pupils reacted briskly to light. The vision in each eye was perception of light only.

From his general behavior, gait, and so forth, the first impression was that the case was one of hysteria, especially as the fundi were normal and there was no sign of inflammation about the eyes. Going into his history, however, it was found that his visual disturbance had begun very definitely 10 days previously, and that during the last four days he had been unable to see sufficiently to move about in his home. Apart from the loss of vision and the pain in and about the eyes, there was no further complaint. The history also elicited the fact that his blindness followed a severe coryza which had succeeded his becoming chilled while watching an outdoor game. He was sent to the hospital, where a neurological examination was made (F. L. McN.).

The patient was mentally clear and alert, with no other complaints than blindness and ocular discomfort. The vision seemed completely gone, with the possible exception of ability to see hand movements in the extreme periphery of his visual field. There was slight supraorbital tenderness. The pupils were large, the left being slightly larger than the right, and they reacted promptly to light, both direct and consensual, but through a very small range. There was marked constriction of the pupils on convergence. Movements of the eyeballs were normal to the right and left, but the upward gaze was definitely limited. There was no nystagmus. The tendon jerks were very brisk as were also the abdominal reflexes, but otherwise neurological signs were normal. On general physical examination he was found to be quite normal. A detailed examination of the nose and throat and X-ray films of the sinuses showed them to be normal. There was no history of exposure to lead, alcohol, or other toxic substances that might cause retrobulbar neuritis.

In attempting a diagnosis, hysterical blindness was at first considered. The definite signs just outlined, however, indicated the presence of an organic lesion affecting the optic tracts and possibly the midbrain nuclei (because of the limitation of the upward gaze). A neoplasm of the pituitary gland could hardly cause such complete, rapidly developing blindness in the absence of severe headaches. Encephalitis periaxialis diffusa (Schilder) may begin in adult life with visual disturbances, but the defect is almost al-

ways a homonymous hemianopia, blindness never becomes complete early in the disease, and as the lower visual centers are intact, the pupillary reflexes remain normal. Other cerebral symptoms, such as bilateral spasticity, aphasia, and mental deterioration, develop gradually as the disease progresses. In multiple sclerosis the first symptom may be an acute unilateral retrobulbar neuritis, but it is never bilateral at the onset, as it was in this case. Because of the rapidly progressing bilateral blindness without any evident cause, and even in the absence of spinal symptoms, a diagnosis of neuromyelitis optica was suggested. Later developments confirmed this diagnosis.

On February 24th, lumbar puncture produced a clear, colorless spinal fluid, with initial pressure of 155 mm. water. The fluid contained 27 small lymphocytes per cubic millimeter, and the Pandy test was strongly positive. Total proteins, however, were 0.010 gm. percent, a low normal value. The value of chlorides was .700, of sugar .100, and the Wassermann and colloidal gold reactions were negative. Spinal-fluid cultures exhibited no growth.

On March 1st, when his vision had shown considerable improvement, the patient, while still in bed, first noticed difficulty in urination. A few days later, when at home, he became aware of a gradual weakness of the legs, followed by involuntary urination and defecation, and he began to complain of soreness of the skin of the upper chest and arms, which, he declared, felt "like sunburn."

On March 25th, examination showed the clear signs of an extensive spinal lesion. The legs were weak, the tendon jerks in the arms and legs were much more active than on the first examination in February, abdominal reflexes were present, and bilateral extensor plantar responses and ankle clonus were elicited. Pain and temperature sensation were practically absent to the level of the umbilicus, while touch and position, and vibration senses remained intact. About the sensory level there was a wide band of painful hyperesthesia, extending at least to the third rib in front and to the arms. In addition, rigidity of the neck and tenderness of the cervicothoracic spine were present. Limitation of upward gaze was still evident. There was a coarse tremor of the outstretched hands, which was increased on attempting to touch the finger to the nose.

On April 4th, a regular well-sustained lateral nystagmus was noted on looking to the right or left. Some weakness of the right hand and arm was also present. Since that time there has been a gradual but steady improvement, with a slow return of neurological findings to normal. In March, 1937, there was still slight difficulty with bladder and bowel control. There was no weakness of the arms or legs and no sensory disturbances were present at this time. Ocular movements in all directions were full, and the nystagmus had disappeared. There was still a slight tremor of the outstretched hands. Reflexes were normal.

The progress of the patient's recovery of vision was equally satisfactory. On March 8, 1936, an improvement in the vision was noted, and by March 30th, the vision of his right eye had improved to 6/36, and of his left eye to 6/60. In May his vision was 6/18 in each eye, and in July it was 6/9. The patient was seen on April 5, 1937, when the vision in the right eye was found to be normal, and that in the left slightly less than normal. The fundi and the visual fields were normal, and the central scotoma for green, which had been present up to his previous examination in October, had entirely disappeared.

During the acute stage of the disease the temperature never rose above 100°F. No abnormalities were observed in the

heart, lungs, or abdomen. Urinalysis and blood counts were normal. Blood chemistry (urea N, creatinin, and sugar) was normal and the blood Wassermann reaction negative. There was a loss of over 20 pounds in weight while the patient was bedridden, which has since been regained.

*Treatment.* From the outset the patient was put upon a high-caloric, high-vitamin diet, and received potassium iodide, 60 gr. daily, and an alkaline tonic. Tryparsamide and novarsenobenzol were administered, but discontinued promptly when visual disturbance seemed to increase after the injections of these drugs. During his convalescence at home, the patient has lived a quiet, simple life, taking a normal amount of exercise.

*Case 2.* A. P., an Italian male of 41 years, in the service of Dr. F. H. Mackay, was seen by one of us (S. H. M.) on December 31, 1931, upon a request for fundus examination. He gave a history that four weeks before his admission to the hospital, on December 23d, he had developed a tingling in the left hand, followed by weakness of the left hand and arm, and that three days before his admission he had noticed that the vision of his left eye was affected. Severe headache, mainly left sided, had been present for two weeks. Weakness in the left leg had developed, followed by diminished vision in the right eye.

By January 7, 1932, there were numerous signs of an almost complete transverse myelitis in the cervical region of the cord. Both arms and legs were very weak and ataxic. Tendon reflexes were unequal on the two sides, and the abdominal reflexes were weak. There was a sensory level at the fourth cervical segment, below which touch, pinprick, and temperature sensations as well as the sense of position and vibration were greatly impaired. There were no sphincter disturbances other than urinary incontinence, which occurred several times. The cranial nerves were normal, apart from the severe loss of vision and a diminished left corneal reflex.

The fundi were first examined on December 27th, four days after admission to the hospital, and were found to be quite normal. A note was added, however, that the disc of the right eye seemed to be slightly reddened and should be closely watched for any further changes. Vision at this time was very defective—with the right eye he could count fingers at 6 feet, while with the left he had only the ability to see hand movements at 1 foot. He was examined at regular intervals, and on January 7, 1932, it was noted that now a definite double papillitis was present. The disc changes were thought to be inflammatory and not edematous, and the marked diminution of vision to be due to the associated retrobulbar neuritis.

The patient made fairly satisfactory general progress. When examined on January 20th it was noted that the fundi were normal, although vision improved more slowly. The spinal symptoms receded gradually. By February 20th there was definite improvement. In June he began to walk with support, and at this time the visual fields were normal except for a very small scotoma in the right.

General examination was essentially normal, except for infected, hypertrophied tonsils; X-ray films of the sinuses showed slight cloudiness of the antra. The temperature remained normal throughout. Routine urinalyses, blood counts, and blood Wassermann tests were negative. The spinal fluid was examined four times and found to be completely normal: under normal pressure, clear and colorless, cells 1-4, Pandy test negative, and there were normal values for protein and chlorides. Wassermann and colloidal gold tests were negative.

Treatment consisted of high-vitamin diet and daily doses of calcium gluconate intravenously during the acute stage.

Upon request the patient returned to the clinic in April, 1937, five years after his acute illness. There had been no relapses. Vision, fundi, and fields in each eye were normal. He walked with a somewhat spastic gait, but could go about easily with the aid of a cane and could walk a mile without difficulty. The legs were a little weak, with hyperactive tendon jerks in arms and legs, bilateral plantar extension, and sluggish abdominal reflexes. Apart from slight diminution of pain sensation below the fourth cervical segment, sensation was normal.

## Summary

Two cases of myeletis with striking loss of vision are reported. In both there has been ultimate recovery of vision, but incomplete recovery from the myelitis.

In case 1, an adult male, a Canadian, 34 years old, there was a definite history of infection. Visual disturbance, simultaneous in both eyes, and eye discomfort were the first symptoms complained of. These were followed later by transverse myelitis of moderate degree. There were no fundus changes, and recovery was practically complete. The spinal fluid exhibited some evidence of an inflammatory process.

In case 2, an adult Italian male, 41 years of age, there was no history of infection. Visual disturbance occurred first in one eye and then in the other, with a considerable interval between the attacks. Eye discomfort similar to that present in case 1 was also complained of. The eye symptoms in this case followed the symptoms of myelitis, which were much more severe than in case 1, and resulted in incomplete recovery. Definite fundus changes occurred during the course of the disease. Examination of the spinal fluid showed no change.

Both cases have been recently examined (April, 1937). The vision, fundi, and fields in each were quite normal. It is of neurologic interest that, in addition to the signs of optic-tract and spinal-cord disease, both cases showed slight signs indicating invasion of the brain stem. In case 1 there was limitation of upward gaze early in the illness; later, lateral nystagmus developed. In case 2, a diminished left corneal reflex was manifested. Such signs have been reported in some cases of neuromyelitis optica.

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## Discussion

Dr. Sanford R. Gifford, Chicago: I would like to place on record two cases which I consider to belong definitely in this syndrome, and one which I believe is of similar nature. Of the two definite cases, one was reported by Dr. Perritt from the Cook County Hospital in 1934, and he mentioned my other case. These cases are so dramatic that they could never be overlooked if a typical case has been seen before.

The first case was that of a boy of twelve. When I saw the patient the disc was elevated six diopters, and there was absolutely no light perception in the affected eye. The other eye was normal. He was perfectly healthy. In this case one could think only of a tumor in the optic nerve. The condition was undiagnosed. Two weeks after I saw him, he fell while walking and was taken to the hospital, where a diagnosis of transverse myelitis was made. During his stay in the hospital vision in the other eye fell to hand movements; no change in the disc was observed at any time. In the eye first affected a typical optic neuritis was present; in the second eye there was a retrobulbar neuritis. In two months the condition had gradually cleared up, and two months later the vision was 20/20 in each eye. The nerve of the first eye was pale and showed changes resembling secondary atrophy, but vision was normal. In the other eye there was a slight pallor of the disc.

The second case, reported by Perritt, was that of a girl of five. In this case the myelitis had preceded optic neuritis. She had had measles three or four weeks before, with paralysis of one leg. One day when she awakened she could see nothing with either eye. She was brought to the hospital, and we found a mild optic neuritis in one eye and no light perception in either eye. The condition cleared up later and she left for another city; reports from there showed vision of 20/20 in one eye and 20/40 in the other.

In the second child the spinal fluid showed 97 cells per c.mm.

Recently I have seen a case with Dr. Lawson, of Evanston. The symptoms were confined to a sudden loss of vision first in one eye and then in the other. There was a mild optic neuritis of both eyes, and the vision was 5/200 in each eye, with a large central scotoma. This patient was a girl of nine years. Spinal puncture and neurologic examination were negative. No myelitis was present, and vision has returned practically to normal. Dr. Lawson has not mentioned any elevation of the discs at the present time.

An interesting question has been raised as to whether these cases would later show the changes of multiple sclerosis, because we have here condensed in a few weeks what happens in multiple sclerosis during the course of years, and it has been suggested that these changes are an acute form of sclerosis. I do not know of any cases that have been followed long enough to determine whether they will show these neurologic signs. So far as I know, none of our cases has.

Dr. Alan C. Woods, Baltimore: We have been so unfortunate as to see a number of cases of neuromyelitis optica, and likewise cases of Schilder's disease, encephalitis periaxialis diffusa, all of which constitute apparently the same pathologic condition, an acute demyelinizing disease with different clinical syndromes. As Dr. Gifford and Dr. McKee have emphasized, at the onset these cases are often quite similar. The eye symptoms predominate, and there may be great confusion as to the exact diagnosis, which becomes evident only with the later development of the myelitis. Due to the early diagnostic uncertainty, three of our cases were subjected to operative procedures—one to an

exploratory craniotomy, one to an air injection of the ventricles, and one to the opening of the posterior nasal sinuses. The ultimate visual outcome in all these patients was bad. Those patients not operated on and not subjected to a lumbar puncture all made remarkable recoveries. In these dramatic cases it seems to me that any operative or traumatizing procedure, even a lumbar puncture, is contraindicated.

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## CHRONIC CELLULAR INFILTRATION OF THE UVEA IN SEPTIC ENDOPHTHALMITIS OF ECTOGENOUS ORIGIN*

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*Saint Louis*

It is proposed to discuss here some of those cases of penetrating injury, operation, or of corneal ulcer, in which, associated with a large number of polymorphonuclear neutrophile leucocytes in the vitreous, the ciliary body principally and, to a less extent, also the choroid present infiltration with small round cells; namely, small lymphocytes and plasma cells. At the same time, the anterior part of the eye may show similar change; namely, hypopyon in the anterior chamber and small round-cell infiltration in the iris. The anatomy of the eyeball, however, makes the conditions as found in relation to the ciliary body to be the most significant for any part of the uveal tract. The choroid is of less importance in these cases because it is protected by the retina from the primary toxic focus in the vitreous.[1] As regards the iris, intensive and prolonged inflammatory processes may exist in it alone without destruction of the eyeball.

### THE CILIARY BODY

The anterior part of the vitreous is that enclosed by the ciliary body and the posterior part that by the retina. It would be more accurate to designate them the cyclitic and the retinal portions of the vitreous.

S. Ruge[2] in a discussion of the relation of traumatic uveitis to sympathetic ophthalmia described the clinical and anatomic findings in 14 cases of eyeballs with purulent inflammation and in 20 eyeballs with fibrinoplastic (chronic) inflammation, following a penetrating injury. Among 10 out of the 14 eyes with pus in the vitreous, the ciliary body was infiltrated with small round cells. Changes in the choroid and iris varied considerably. Ruge concluded that, after a time, either the fibrinoplastic or chronic inflammation developed because of the weakening of the primary toxin or that a mixed infection prevailed from the beginning. The element of time in Ruge's 10 cases may have been of some importance, for the interval between the perforating injury and the enucleation was 8 days in one case, 2 weeks in four cases, 2½ weeks in two cases and 4 weeks, 5 weeks, and 10 weeks each in a single case.

E. Fuchs[1] wrote that only two fundamentally different kinds of infection could explain the simultaneous presence of a purulent exudate in the vitreous and a chronic infiltration in the ciliary body. He pointed out that since pus cells in the vitreous are derived from the retina as well as from the ciliary body, the term septic endophthalmitis rather than purulent uveitis is more applicable to the gen-

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eral acute process. In addition, he stated that it is the primary deposit of toxins in the aqueous and vitreous chambers and their chemotactic action exerted from these situations, that accounted for the infiltration of cells within the iris, ciliary body, and retina and the exudate of cells into the aqueous and vitreous chambers. It was Fuchs's opinion that the infiltration of the uvea with round cells in these cases could only indicate a beginning sympathetic process.

J. Lossen[3] made a study of the type of the exudate upon the free surface and the kind of cells infiltrating the serosa in 33 patients, in which the pleura was inflamed 27 times, the peritoneum 10, and the pericardium twice. It was found much more frequently that whereas the exudate consisted of polymorphonuclear leucocytes, the infiltrating cells in the serosa were small round cells. The author concluded that whether the cells in the exudate were acute or chronic depended more upon the intensity of the inflammation than upon the exciting agent itself.

E. Fuchs[4] mentioned that in cases of septic endophthalmitis after penetrating injury, in which the retina is giving off many polynuclear leucocytes, the underlying choroid is frequently infiltrated only with lymphocytes. In the same kind of cases, in which an abscess is present in the anterior part of the vitreous, the posterior part of the retina further removed from the source of the inflammation might contain only lymphocytes.

From the above, it seems to be well established that the same irritant at first, or nearby, causing the appearance of acute inflammatory cells may later, or farther away, lead to the production of chronic inflammatory cells. This proposition is of fundamental importance to this study. Another fact that materially helps to explain the findings in these cases was pointed out by Lossen,[3] that the character of the exudate depends upon the intensity of the inflammatory process. The factors that determine the latter must be the virulence and amount of the bacterial or other toxins together with the resistance of the infected part.

Clinically, the character of the inflammatory process in the iris or ciliary body is diagnosed by the type of the exudative cell predominant in the anterior chamber or anterior part of the vitreous. When the cells in the exudate are chronic cells as determined by the appearance in the beam of the slitlamp, it is certain that a chronic process exists in the iris or ciliary body.

On the other hand, when polymorphonuclear leucocytes or pus cells prevail in the exudate, it will be seen from the present study that frequently the infiltration, particularly in the ciliary body and to a less extent in the iris, is decidedly chronic. In spite of this inconsistency, for all practical purposes during the first few weeks of the inflammation, it is entirely correct to base the procedure chosen on the character of the exudate. It is only later in the inflammatory process that chronic-cell infiltration within the uvea may become significant.

The cell of the exudate upon the free surface of the ciliary body in both the acute and chronic types of inflammation is always a phagocytic cell, for the latter is the only one capable of migrating long distances from its parent tissue. The microphage or polymorphonuclear leucocyte, characteristic of acute inflammation, comes solely from the blood. The macrophage, characteristic of chronic inflammation, is a derivative of the reticuloendothelial system; hence to form the exudate in the eye it comes partly from the tissues and partly from the blood.

Connective-tissue membranes occur only in chronic inflammation. The old designation of "fibrinoplastic," as applied

to chronic inflammatory processes exhibiting the formation of membranes and as used by Ruge, is subject to criticism. Exudates of fibrin do not accompany chronic inflammation. In a recent paper, read before the American Ophthalmological Society, the present writer[5] described the successive stages in the formation of fibroblasts from macrophages along the inner surface of the ciliary body as the initial process in the development of the cyclitic membrane.

From the collection of the Laboratory for Ophthalmic Pathology at the Washington University School of Medicine, it was found that, in all, 32 eyes showed the presence of substantial quantities of polymorphonuclear neutrophile leucocytes along the free surface of the ciliary body or in the anterior or cyclitic part of the vitreous. Of these 32, only eight eyes were from uncomplicated cases of frank septic endophthalmitis. In other words, in only eight was no infiltration, or only polymorphonuclear leucocytes, noted in the ciliary body and iris. All the eight were from cases of penetrating injury, and in all, enucleation of the eye was performed less than 14 days from the date of the injury. In each case, even in those eyes removed one, two, and three days following the injury, macrophages in relatively small numbers as compared with the pus cells were present in the anterior and posterior vitreous as well as in the anterior chamber.

Before tabulating the remaining 24 eyes, or those with complicated septic endophthalmitis, attention must again be directed to the great importance of conditions in the ciliary body in these cases of penetrating wound. The presence clinically of visible quantities of pus cells in the anterior part of the vitreous, derived, of course, from the ciliary body, definitely indicates a hopeless prognosis for the eye. It is true that the anterior media are usually too cloudy to enable the observer to distinguish a purulent exudate into the vitreous. Again, in chronic inflammation, when, after a restoration to normal of the intraocular tension following the penetrating injury, the eyeball later softens, an interference with the formation of the aqueous humor from the ciliary processes is the basic factor. This is another clinical sign from the ciliary body, indicating an irreparable impairment to the integrity of the eyeball. Only after this primary softening does the cyclitic membrane begin to develop in the later stages of chronic inflammation. The tabulation to follow with its emphasis on conditions in and near the ciliary body has therefore a clinical as well as a pathologic justification.

The 24 eyes herewith listed all presented, in addition to numerous pus cells in the anterior part of the vitreous chamber, an infiltration with small round cells in the ciliary body. In other words, an exudate of mainly acute inflammatory cells in the anterior part of the vitreous, derived mainly from the ciliary body was accompanied by an infiltration of chronic inflammatory cells within the ciliary body With anterior penetrations, or those through the cornea or corneoscleral junction, the largest exudate of pus cells was usually into the anterior part of the vitreous. Conditions in the retina, although important, are not included in the table, both because they are not relevant to the present study and because of the very special character of the retina. They may be inferred to some extent from the character of the inflammatory cells in the posterior or retinal part of the vitreous.

The 24 eyes in the table include 19 with penetrating injury, three with intraocular operation, and two with perforating corneal ulcer. Under each of these three headings, cases are listed ac-

cording to the interval between the time of the penetration and that of the enucleation.

As in the eight cases of uncomplicated septic endophthalmitis, here also macrophages were observed in the anterior part of the vitreous very early in the inflammatory process—two days in one case.

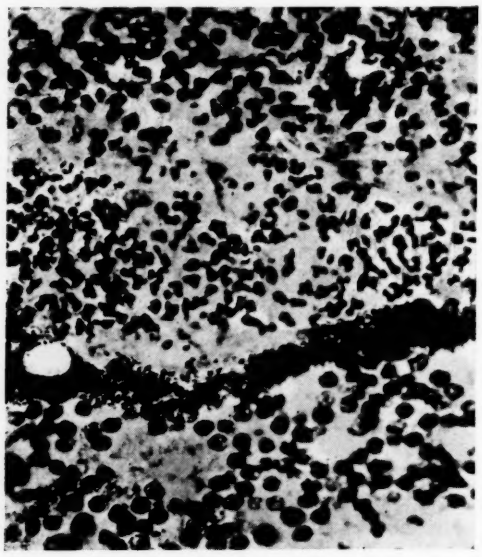

Fig. 1 (Lamb). Chronic inflammatory cells externally and acute inflammatory cells internally in the ciliary body of an eye with septic endophthalmitis. × 450. Case 1428.

In addition, when there had been sufficient time—ten days the earliest in the table—the cyclitic membrane presented a considerable start. The thickness of the cyclitic membrane, as can be seen, usually bears a direct relation to the number of macrophages in the anterior vitreous. The macrophage was the only mononuclear cell that occurred in the anterior or cyclitic part of the vitreous in these cases.

As was observed in each of the 32 eyes, or the total number with septic endophthalmitis, the macrophages in the anterior vitreous congregated fairly close to the inner, free surface of the ciliary body; whereas the polymorphonuclear leucocytes tended to migrate farther into the vitreous. These findings harmonize with those reported by A. E. Wright[6] in blood tissue-cultures, in which the polynuclears moved faster and farther than the macrophages. These conditions in the cyclitic part of the vitreous would help to explain why the cyclitic membrane, developed from macrophages, tends to begin close to the ciliary body. On the other hand, the pus cells tend to collect just behind the lens. True encapsulated abscesses in the vitreous usually lie at that situation.

A close study of the histology in numerous cases of septic endophthalmitis cannot help but convince the examiner that the ciliary processes present an important obstruction to the influence of toxins in the posterior chamber. In all of the 32 eyes in this series, the difference in the amount of cellular infiltration within the ciliary body was striking, between the anterior coronary and the posterior orbicular portions of that structure. Always less also was the quantity of pus cells in the exudate from the ciliary processes as compared with that from the orbiculus ciliaris. Differences between the two portions of the ciliary body were particularly accentuated in the 24 eyes with small round-cell or chronic infiltration within the ciliary body, both as regards the exudate and the infiltrate. In the case of the infiltration in the 24 eyes, few round cells were present anteriorly. Posteriorly they lay in the outer part of the vascular layer or between the inner loose longitudinal bundles of the ciliary muscle. Generally, this infiltration was more marked at the ora serrata, where it also involved the choroid. When polymorphonuclear leucocytes or acute inflammatory cells also infiltrated the ciliary body, they were likewise present in much greater numbers posteriorly and lay within the inner part of the vascular layer, with considerable invasion of the inner-

lying and swollen interlamellar connective tissue and the two layers of the ciliary epithelia. In five of these eyes, acute and chronic inflammatory cells occurred in places at the same anteroposterior level of the orbiculus ciliaris, the pus cells internally and the small round cells externally (fig. 1). As can be seen from the table, the inflammatory process in these five cases had run but a brief period. The explanation for the simultaneous presence of acute and chronic inflammatory cells within the ciliary body must be that at first acute cells appeared as a reaction to the strong irritant. The latter was naturally weakened within the ciliary body by the defensive forces in the blood and tissues. This weakened toxin, constantly diffusing, reached the external layers and provoked the infiltrate of chronic cells. The chronic infiltration in the ciliary body was small to moderate in degree except when designated in the table as dense.

### The choroid

In regard to the elements for the choroid, it must be remembered that the cellular exudate in the posterior or retinal part of the vitreous is derived from the retina. Nevertheless it is the toxins in the posterior vitreous in these cases that produce the infiltration in the choroid.

In one (no. 1971) of the 24 eyes in the table, an evisceration had been done, with removal intact of the anterior half of the eyeball, including the detached retina. In seven of the remaining 23 eyes, small round-cell infiltration in the choroid was dense and greater than in the ciliary body. Among these seven eyes, in four, none with an inflammatory process more than seven days old, the retina presented an intensive and destructive purulent condition. In these four eyes, similar to conditions in the ciliary body, dense numbers of pus cells infiltrated the inner layers of the choroid, whereas dense numbers of small round cells were located in the outer layers of the choroid, frequently at the same anteroposterior level. Where the retina was completely destroyed by the purulent process, the infiltration in the choroid was almost altogether of pus cells. In two more eyes (nos. 1021, 785) of the seven, although the inflammation was 4½ and 3 weeks old respectively, the purulent process in the retina was in places quite destructive. Where the latter occurred, small round-cell infiltration in the choroid was pronounced. In the remaining one (no. 1899) of the seven eyes, the interval from the initial perforation of the corneal ulcer had been long enough to produce a diffuse cystic degeneration of the retina. In these seven eyes therefore, a considerably increased porosity of the retina would seem to have been the essential factor in producing a dense infiltration of the choroid. The lesser degree of infiltration of the ciliary body with small round cells in these seven eyes would seem to have been due to the exposure of the inner surface of that structure to the same strong toxins which posteriorly must first have passed through the retina to affect the choroid. These strongly acting toxins produced largely an exudate of pus cells from the ciliary body into the anterior part of the vitreous and only a small amount of cellular infiltration within the ciliary body. Because the ciliary body has a much greater blood supply than the retina, the exudate of polynuclears was much greater from the ciliary body than from the retina in eyes with septic endophthalmitis.

In one other eye (no. 1861) not included in the seven having greater round-cell infiltration in the choroid than in the ciliary body, the simultaneous acute and chronic cellular infiltration was present to a small degree only in the anterior half of the choroid. The proportions of the choroid involved by the simultaneous

acute and chronic cell infiltration in all five cases were not so constant as in the ciliary body. The small round cells were rarely found in quantity as far internally as the choriocapillaris and the polymorphonuclear leucocytes were rarely present in dense numbers in the outer layer of large vessels.

With the exception of the seven eyes was mild to moderate in degree. In six of these 13 eyes, the infiltration was observed only in the anterior half of the choroid and in the other seven, only near the ora serrata. The principal reason for this greater involvement of the anterior part of the choroid must be the more rapid degeneration in these cases of the anterior part of the retina because of its

TABLE 1

DATA ON 24 CASES OF COMPLICATED SEPTIC ENDOPHTHALMITIS

| Case No. | Kind of Injury or Operation | Interval between Penetration and Enucleation | Anterior Vitreous | | | Ciliary Body |
|---|---|---|---|---|---|---|
| | | | Quantity of Pus Cells | Quantity of Macrophages | Size of Cyclitic Membrane | Type of Infiltration |
| | CASES OF PENETRATING INJURY | | | | | |
| 544 | part. steel in vitreous | 2 days | many | moderate | none | acute intern. chronic extern. |
| 61 | corneal wd. from weed | 4 days | many | few | none | acute intern. chronic extern. |
| 1428 | unknown f.b., corneal wd. | 5 days | many | moderate | none | acute intern. chronic extern. |
| 999 | part. steel in vitreous | 7 days | many | many | none | chronic extern. |
| 562 | corneal wd., screwdriver | 9 days | many | moderate | none | chronic extern. |
| 1861 | part. steel in vitreous | 10 days | many | many | thick | acute intern. chronic extern. |
| 565 | unknown f.b., wd. at limbus | 2 weeks | many | many | thick | chronic extern. |
| 1330 | fork injury wd. at limbus | 2 weeks | many | many | thick | chronic extern. |
| 1345 | part. steel in vitreous | 3 weeks | many | moderate | none | chronic extern. |
| 1645 | part. steel in vitreous | 3 weeks | many | many | thick | chronic extern. |
| 98 | shot, p. wd. at equator | 3½ weeks | large abscess | many | thick | chronic extern. |
| 1021 | nail injury thr. cornea | 4½ weeks | many | many | thick | chronic extern., dense |
| 1041 | glass injury, wd. at limbus | 5 weeks | many | moderate | thin | chronic extern., dense |
| 1374 | piece steel thr. cornea | 5 weeks | many | few | none | acute and chronic, diffuse |
| 1970 | mass steel corneal wd. | 5 weeks | many | many | thin | chronic extern. |
| 70 | part. steel in vitreous | 6 weeks | large abscess | many | thick | chronic extern., dense |
| 250 | copper wire thr. cornea | 6 weeks | moderate | moderate | thin | chronic extern. |
| 1132 | shot injury, wd. at limbus | 4 months | many | many | thin | chronic extern. |
| 1275 | glass, p. wd. at limbus | 4 months | many | many | thick | chronic extern. dense |
| | CASES OF PENETRATING OPERATIVE WOUND | | | | | |
| 2119 | trephine | 7 days | many | moderate | none | chronic extern. |
| 785 | cataract extraction | 3 weeks | many | moderate | thin | chronic extern. |
| 482 | iridectomy f. glaucoma | 6 weeks | many | many | thin | chronic extern. dense |
| | CASES OF PERFORATING CORNEAL ULCER | | | | | |
| 1971 | | 4 days | many | few | none | acute intern. chronic extern. |
| 1899 | | 3½ months | many | few | none | chronic extern. |

mentioned and of two more having an equivalent small amount in ciliary body and choroid, the 14 remaining eyes had a lesser degree of chronic-cell infiltration in the choroid than in the ciliary body. Only in one (no. 482) of these 14 eyes was the infiltration with small round cells dense in the choroid, and that only in its anterior half. Internal to the latter here, the retina was intensively affected by the purulent process belonging to the endophthalmitis. In the remaining 13 eyes, the small round-cell infiltration in the choroid comparatively poor blood supply. Accompanying and probably dependent upon the latter was the characteristic defective development and cystoid degeneration of the anterior end of the retina. As a result, toxins in the posterior vitreous more easily passed through the anterior part of the retina to exert their influence upon the corresponding part of the choroid.

## THE IRIS

The iris requires only brief mention. From the table, it can be readily observed

that the amount of hypopyon was no criterion as to conditions behind the iris and lens. Infiltration of the iris, at least in part, with small round cells was present in 14 out of 18 eyes or in all but a few eyes removed in the earliest stages of the infection. The arrangement of all inflammatory cells was generally a diffuse scattering in a small to moderate degree of

## Conclusion

The most characteristic change of septic endophthalmitis is the large number of polymorphonuclear leucocytes along the inner surface of the ciliary body and in the anterior part of the vitreous. An examination of 32 eyes with septic endophthalmitis of ectogenous origin showed the presence in each one of some

TABLE 1 (*Continued*)

Data on 24 cases of complicated septic endophthalmitis

| Posterior vitreous | | Choroid | Anterior Chamber | | Iris |
|---|---|---|---|---|---|
| Quantity of Pus Cells | Quantity of Macrophages | Type of Infiltration | Amount of Hypopyon | Quantity of Macrophages | Type of Infiltration |
| **CASES OF PENETRATING INJURY** | | | | | |
| moderate | moderate | acute intern. chronic extern. | small | moderate | acute, diffuse |
| many | moderate | acute intern. chronic extern. | small | few | acute, diffuse, dense |
| many | few | acute intern. chronic extern. | small | moderate | acute, diffuse, dense |
| many | moderate | chronic extern. | small | few | acute and chronic, diffuse |
| moderate | few | chronic extern. | (traumatic aniridia) | | |
| many | moderate | acute intern. chronic extern. | large | few | acute, diffuse |
| many | moderate | chronic extern. | small | few | chronic, posteriorly |
| moderate | moderate | chronic extern. | (no anterior chamber) | | chronic, diffuse |
| moderate | many | chronic extern. | small | few | chronic, diffuse |
| many | many | chronic extern. | large | many | chronic, diffuse |
| few | few | chronic extern. | small | few | chronic, posteriorly |
| many | many | chronic extern., dense | large | few | acute and chronic, diffuse |
| moderate | moderate | chronic extern. | small | moderate | chronic, diffuse, dense |
| few | few | chronic extern. | small | few | acute and chronic, diffuse |
| many | moderate | chronic extern. | (no anterior chamber) | | |
| many | many | chronic extern. | (no anterior chamber) | | |
| many | many | chronic extern. | small | few | chronic, diffuse |
| few | many | chronic extern. | none | few | chronic, diffuse, dense |
| many | many | chronic extern. | none | few | chronic, diffuse |
| **CASES OF PENETRATING OPERATIVE WOUND** | | | | | |
| many | few | acute intern. chronic extern. | large | few | none |
| many | moderate | chronic extern., dense | (no anterior chamber) | | |
| moderate | many | chronic extern., dense | large | many | chronic, diffuse, dense |
| **CASES OF PERFORATING CORNEAL ULCER** | | | | | |
| many | few | (Evisceration—iris completely prolapsed) | | | |
| many | moderate | chronic extern. | small | few | acute and chronic, diffuse |

infiltration. The reaction of the iris to toxins is naturally less than that of the ciliary body because in the thin aqueous humor of the anterior chamber toxins are more easily carried away than in the jelly-like vitreous. The general lack of arrangement of the cellular infiltration in the iris, unlike that in the ciliary body and choroid in these cases, would indicate that toxins enter the iris from both the anterior and posterior surfaces and not from the inner surface only as in the other two parts of the uvea.

macrophages or exudative cells of chronic inflammation, in the anterior and posterior vitreous as well as in the anterior chamber (when the latter could be studied). In the case of 24 among these 32 eyes, having small round-cell infiltration in the ciliary body and choroid, the macrophages in the anterior and posterior vitreous tended to increase in numbers with the duration of the inflammatory process. In every case of septic endophthalmitis, therefore, there was present a chronic factor which tended to intensify as the

original virulence of the etiologic toxin weakened.

Attenuation of the latter by distance was also illustrated in each of the 24 tabulated cases by the presence of an infiltration of small round cells in the outer part of the vascular layer of the ciliary body and in the external layers of the choroid. Although it is true that the type and situation of this infiltration was similar to that found in the incipient stage of sympathetic cyclitis and choroiditis, as emphasized by E. Fuchs,[7] sympathetic disease cannot even be imagined here. The findings tabulated were the rule and not the exception.

In the ciliary body principally, but to some extent also in the iris, the more virulent toxin produced only an exudate of pus cells into the anterior vitreous or anterior chamber with no cellular infiltration in the parent-tissue, a less virulent one led to an infiltration of pus cells in the ciliary body or iris together with the exudation of the same cells, while a still weaker toxin caused an infiltration of small round cells in these portions of the uvea together with an exudate of macrophages. As to the choroid, the same was true in so far as the infiltration of inflammatory cells within that structure was concerned, but quite different for cellular exudation from the choroid. It is certain that macrophages cannot, and doubtful whether pus cells are able to, penetrate the intact lamina vitrea of the choroid and the pigmented epithelium of the retina.

The regularity of the cellular findings in the infiltration of the ciliary body and choroid together with that of the exudation from the ciliary body cannot but convince the observer that a simple toxin here prevails, the reaction to which varies, as determined by Lossen,[3] with the intensity of the inflammatory process (or the viruluence and amount of toxin versus the resistance in the eye).

All sections for this study were prepared in the Laboratory for Ophthalmic Pathology, Washington University School of Medicine.

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# DIAGNOSIS AND TREATMENT OF THE PHORIAS*

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## GENERAL CONSIDERATIONS

As a cause of eye discomfort and deficiency the phorias take almost if not quite equal rank with asthenopia resulting from refractive errors. Such asthenopia requires careful study and more skillful understanding than the study of refraction. Orthoptics is not a cure-all for the phorias or squint, but it is a valuable addition to our armamentarium in the treatment of these conditions.

It is obvious that a diagnosis must be made before we can intelligently treat a phoria. First, a careful study of the ocular apparatus is essential to determine if the phoria be primarily of ocular origin or secondary to some other cause.

## TESTS FOR PHORIAS

There are many such tests. The following have been used with satisfaction.

*Cover test* (Screen test). This is important in that it uncovers certain degrees of phoria that may be overlooked with the Maddox Rod. For example, in abnormal retinal correspondence, the Maddox Rod may be misleading and indicate no squint or an incorrect type. If false projection exists there may be incongruous diplopia; for example, in the presence of an exophoria, the Maddox Rod being over the right eye, the red line may appear to the right of the test light instead of to the left.

Combined with the cover test a prism is used to measure the degree of phoria. This is the most valuable test because it is easily and quickly made and is accurate in almost all cases. It should be made with the patient fixating the "muscle" light at six meters and at 33 cm. *with and without* the correction of the refractive error. This enables one to determine the effect of the correction of the refractive error upon the phoria, which is an important factor. The same test should be made *with the patient accommodating.* When looking at the muscle light he may not accommodate, hence he is asked to read small test type at six meters and 33 cm., and the cover test and measurement by prisms with and without the correction are made.

It is essential that the patient make every effort to use his full accommodation. For children small toys or pictures are substituted for letters.

The difference in the findings measured when accommodating and not accommodating is astonishing in some cases, and important for treatment. If a vertical deviation is found, it should be corrected and the measurement of the lateral deviation noted with and without this correction.

*The Maddox Rod.* The test with this instrument should be made at six meters and 33 cm. with and without correction of the refractive error. The vertical imbalance should be corrected and the test again made with this correction. The difference in such measurements from that made with the cover test may be considerable. It is well to use the cover test in conjunction with the Maddox Rod in order to bring out the latent or full amount of the phoria.

By making the aforementioned two tests, the difference in the findings of the cover test and the Maddox Rod may be due to accommodation being used in the

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cover test, whereas it is less likely to be used in the Maddox Rod test. Using the accommodation brings out the amount of the latent *phoria,* which would not be recognized were the accommodation not so stimulated.

*The "White card."* The two tests described are first made in the primary position. Following this the cover test with prism measurements is made in six positions of the eyes, according to the method of Dr. James Watson White.

A "White card" is filled out in every case. The findings are considered essential for complete diagnosis. The test consists in using the cover test and prisms to measure the lateral and vertical deviations in the following positions: E.R.: E.L.: E.U.R.: E.U.L.: E.D.R.: E.D.L.

This is an objective test and hence can be used in children as well as in adults. The "White" test demonstrates disturbed functions of the elevators or depressors as well as the laterally acting muscles.

A phoria may be secondary to the disturbed function of an elevator or a depressor. Without this knowledge grave errors in treatment are liable to occur. The whole course of the treatment might be different from that followed in a purely lateral imbalance.

*Rotations.* Upon completion of the foregoing tests the rotations of the eyes together and singly in all fields[1] should be carefully studied and compared with the findings in the cover and Maddox Rod tests. Careful notes should be kept as the examination proceeds.

The preceding tests may be augmented by the Parallax test if this is thought to be desirable. Needless to say, one cannot make all these tests at one sitting, nor is it desirable to do so.

It is not necessary nor desirable to make such extended studies except in those who have a symptomatic phoria the cure of which must be undertaken. As a routine in ordinary examinations, the cover test, Maddox Rod, and rotations with both eyes uncovered are used. This will yield all the information necessary and will demonstrate whether more extended study is indicated.

*Convergence near point* (Pc. or Pcb.). It is essential that a careful study be made of this important function. It is often necessary to base the method of orthoptic or surgical procedure on the finding. The test should be made several times and denoted relative or positive. As a clinical procedure the Pc. rather than the Pcb. is generally employed. The Pc. is that point of convergence measured from a plane 9.5 mm. from the anterior surface of the cornea. The Pcb. is that point of convergence measured from the base line; that is, the line connecting the center of rotation of the eyes. For practical clinical usages the former is satisfactory.

*Prism convergence and divergence.* Prism convergence and divergence are sometimes improperly designated as adduction and abduction. The test is usually made at six meters, a small light being used for fixation, and consists in determining the strength of prism diopters that can be overcome by the ocular muscles without producing diplopia at the given distance. It is desirable to make the test at 33 cm. also.

*Prism convergence.* This is variable and should be repeated or it may be misleading. What may at first appear to be a low prism convergence may on further study prove to be normal, or at least higher in degree than was indicated at the first test.

*Prism divergence.* This is simpler to ascertain and varies but slightly. It is none the less important to observe it closely. In divergence excess it may vary considerably but not to such an extent as prism convergence.

Having studied the ocular apparatus it is then possible to determine whether the

phoria is due to a disturbance of the ocular system or is secondary to some other cause.

After the foregoing tests have been made, the patient is placed before the synoptophore for further study and treatment, if necessary. Tests for suppression are made and the angle Kappa measured. The presence of normal or abnormal retinal correspondence is determined. Convergence and divergence fusion power are then tested. The points of breaking of fusion recovery are noted. Tests are made with and without correction.

## Types of Phorias

### EXOPHORIA

*Exophoria of adolescence* is frequently due to: 1. Various debilitating causes. 2. Intensive work at school or college coupled with a sedentary life. 3. Excesses in tobacco, usually due to cigarettes. 4. Insufficient sleep and rest. 5. Improper food and eating habits. All these induce a state of lowered vitality.

The treatment is obvious but it is the *most important* part of the procedure. Orthoptic treatment should be instituted but it is of secondary importance. In such cases prism convergence is usually low. It can be rapidly increased, resulting in quicker recovery of the patient.

Debilitating disease, anemia, chlorosis, and the acute infections may be responsible. Indeed, following any illness, depressing emotion, or excess, a weakness of convergence resulting in symptomatic exophoria may exist.

*Exophoria due to disease of the nasal accessory sinuses:* It is essential that this possibility be known; but to eliminate it is not easy. The definite diagnosis of the presence or absence of nasal-accessory-sinus disease is difficult. It may require consultation with an expert in this work.

The eye surgeon should be able to arrive at a tentative diagnosis by a careful history and investigation, remembering that consultations are costly.

Reflex irritation from nasal or dental disease or abnormality should be considered. Other sources of reflex irritation, such as trigeminal neuralgia, should be given consideration.

*Armed services.* It should be remembered that an exophoria of more than a few degrees will prevent a man entering West Point, Annapolis, or the Flying Corps. Not more than five prism diopters at 6 M. or 12 prism diopters at 33 cm. of exophoria is permitted for a candidate for the United States Military Academy. In the Flying Corps of the Army exophoria of more than two prism diopters is a disqualifying factor if associated with a low angle of convergence; exophoria of five prism diopters is a disqualifying factor even if unassociated with any other condition.

*Essential exophoria.* Essential exophoria[2] has the following characteristics: It is not of symptomatic origin; not caused by accommodative or refractive errors or constitutional disorders. It remains about the same in degree under all conditions and at various times. It does not respond to orthoptic treatment. Anatomical anomalies of the orbits, extraocular muscles, or check ligaments are thought by some to be its cause.

Under orthoptic treatment the degree of the exophoria remains about the same, though the symptoms may be ameliorated temporarily. Orthoptic exercises should be instituted and faithfully carried out, but no longer than necessary to ascertain whether or not the exophoria or its symptoms are yielding to the treatment. If they are not, surgery is indicated and will give permanent and brilliant results, provided the proper diagnosis has been made and the proper operation performed.

If this exophoria is due to divergence excess, recession of the lateral rectus or

both lateral recti is indicated.

If it is due to convergence insufficiency, shortening or advancement of the median rectus or both median recti is advisable.

It may be necessary to augment the convergence even though the case appears to be one of divergence excess with a normal convergence.

*Exophoria and refractive errors.* Refraction should be tested under a cycloplegic, using atropine or scopolamine if necessary, but only if necessary; for the inconvenience and economic loss resulting from cycloplegia lasting two weeks as a result of the use of atropine should be considered.

If the refraction be hypermetropic it may be desirable to undercorrect it. If of low degree, without astigmatism, no correction may be necessary. If the refraction is myopic, usually full correction is desirable if it will be tolerated. Rarely one may overcorrect it.

In children, in adolescents, and in some adults who object to the wearing of glasses it is better to treat the exophoria by other methods, should the refractive error be hypermetropic, or even a low degree of myopia, and there are no symptoms dependent upon the refractive error as such.

In anisometropia and high hypermetropia with poor vision proper correction to restore the vision to normal is necessary. Such patients may have had only monocular vision.

After the correcting glasses have been given, fusion training usually is necessary.

Exophoria is the most frequent disturbance of the vergence and is often accompanied by low fusion power. Orthoptic training directed particularly toward fusion and convergence gives very satisfactory results in this class of patient.

*Senile exophoria* (exophoria of age). This form of exophoria may be due to the weakness, debility, and vicissitudes of advancing years. It is due not infrequently to changes in the central nervous system, nuclear degeneration, or cerebral vascular disease, leading to weakness or paralysis of convergence. This ailment is more common than is realized.

Orthoptic exercises are rarely helpful. Surgery may be of value in suitable subjects. In them it is the most successful measure. Prisms as hook-ons or incorporated in the lenses may be of distinct value.

*Exophoria of endocrine origin.* A case of exophoria should be so classified only if a definite diagnosis of endocrine dysfunction can be made.[7, 8, 9]

Thyroid Dysfunction. Hyperthyroidism and exophthalmic goiter produce marked disturbances of the ocular muscles, exophoria in particular. At certain stages of the disease, orthoptic exercises combined with surgery in properly selected cases are of value. Hypothyroidism is perhaps more frequently responsible than hyperthyroidism. Some patients are incurable as a result of the organic changes in the extraocular muscles and the tissues within the orbits.

Gonadal Dysfunction. The castrated woman suffers great disturbances of the nervous system, which frequently are centered about the eyes and head. Headaches and profound asthenopia on attempting to use the eyes are not uncommon. Not infrequently a marked exophoria is present.

*Presbyopic exophoria.* In early presbyopia, the patient, upon being given correcting glasses, frequently develops discomfort. This is particularly true of women who resent the necessity of wearing glasses and are humiliated by them. This provokes an antagonistic attitude toward the glasses with consequent magnification of resultant discomfort. An exophoria not infrequently develops. This is particularly true where bifocals are nec-

essary. Care should be taken by the surgeon to see that the bifocal segments are properly centered. Improper centering may accentuate the discomfort and the exophoria.

There is also probably disturbance of the accommodative-convergence ratio and some fusional imbalance. A few seances with the stereoscope may be of distinct value in shortening this period of discomfort. Fusion and convergence exercises are usually given.

#### DISTURBANCE OF THE CENTRAL NERVOUS SYSTEM

Impairment of the extra- and intraocular muscles and of convergence and divergence may result from involvement of the central nervous system.

The ophthalmologist must be prepared to make a tentative diagnosis. It may require verification by a competent neurologist. Encephalitis, brain tumor, syphilis, disseminated sclerosis, and allied pathology may be the underlying cause. Functional disturbances such as hysteria, neurasthenia, and other functional neuroses may be responsible. Those having organic disease of the nervous system are not often amenable to orthoptics. The functional disturbances on the contrary may often be much benefited by this form of therapy in well-considered cases. Surgical intervention may be unfortunate.

#### CONVERGENCE PARESIS AND PARALYSIS

It is necessary that we recognize this rather rare condition. It denotes disturbance of the central nervous system. There are probably more frequent cases of convergence weakness of this type than is realized. The so-called "essential exophoria" may be of this character. The value of orthoptics in such a case is questionable. It should be tried. Experience will demonstrate its value.

#### NEURASTHENICS

The more mature one's experience, the fewer such diagnoses. If a patient is neurotic it is usually merely a symptom from physical, mental, or emotional cause. It is the duty of the ophthalmologist to ascertain this.

It is difficult at times to determine whether the phoria is the cause or the result of such disturbances. The presence of a phoria in such patients frequently results in marked symptoms. Orthoptic treatment is of distinct value both for its effect upon the phoria and the mental suggestion that goes with such treatment.

#### CONVERGENCE INSUFFICIENCY WITHOUT PHORIA

We occasionally see convergence insufficiencies that apparently do not cause exophoria, or the exophoria may be slight, or there may be a slight esophoria. Four patients of this type were given orthoptic exercises. All were adults. Three of them improved the convergence power and the symptoms disappeared. In one case no increase in the convergence was produced, but yet the symptoms disappeared, probably as the result of a steadier coördination of the eyes.

#### ANISEIKONIA AND ANISOPHORIA

According to Ames[3] and his co-workers, we may attribute a certain percentage of cases of convergence and divergence imbalance and fusional disturbance to this condition. Friedenwald[4] has given us food for thought in his interesting paper on anisophoria. In obstinate cases of phorias it might be well to consider such a possibility.

### Orthoptic Treatment

#### EXOPHORIA DUE TO CONVERGENCE INSUFFICIENCY

The exophorias due to convergence insufficiency are the most amenable to or-

thoptic treatment of all the phorias. Out of 48 cases of exophoria due to convergence insufficiency in which orthoptic treatment was given, 25 showed reduction or cure of the exophoria, with a return to normal convergence and total absence of symptoms in all 25 cases.

Of the 48 cases 17 had abnormal Pc. when first examined; 14 of these cases improved or became normal under exercise.

Ten of the 48 cases showed no reduction of the exophoria but improvement of convergence and symptoms.

Only two cases showed no improvement; one was a senile exophoria.

Twelve of the 48 cases were incomplete as to tabulation, although some of these were definitely showing improvement. None of the 48 was a case of squint that had been reduced to a phoria by surgery, orthoptics, or other means. No children were included in this group; all were adolescents or adults.

The conclusion from the foregoing series of cases is that 88 percent of the exophorias due to convergence insufficiency, treated orthoptically, received definite benefit.

*Technique for exercise of exophoria due to convergence insufficiency.* The patients are requested to report for treatment twice or three times weekly, for 45-minute periods, until the symptoms are relieved. The average adult requires six to ten treatments.

The Sattler and Guibor charts are mounted on black cardboard and used in the synoptophore. Clark's glass stereoscopic charts are also used. If the patient is a child, the more colorful squint material can be used.

Two charts having stereoscopic effect are inserted in the chart holders. The arms of the synoptophore are equally converged slowly until fusion is broken. The patient is then asked to make a concentrated mental effort to regain fusion at this point. If unable to do so, the arms are gradually and equally diverged until fusion is regained and then converged again until fusion is broken. Gradually the amount of convergence power will be increased. When the patient reaches an average convergence of 60 to 70 prism diopters on the synoptophore, the tubes are rotated laterally while he converges, stimulating the fusion in the lateral fields as well as merely in the primary position. The rotating movement is begun depending upon the stability of convergence. One generally, but not always, has to increase the convergence in the primary position before beginning this exercise. As every case is different there are no hard-and-fast rules for the technique. It is often to be noted that after a few periods of convergence exercises the fusional divergence may temporarily be diminished. At this point fusional divergence exercises are given at the same period as convergence exercises to insure an amplitude of fusion.

In convergence insufficiency it is often of assistance to insert a —3.00 spherical lens before the eyepieces. When slides are viewed through the ordinary lenses of the synoptophore the instrument is adjusted for distance vision. By adding a —3.00 sphere to each lens, in the detachable cells for this purpose, the patient accommodates three diopters and converges three meter angles. Convergence exercises are given with this addition, which appears to stimulate the sluggish convergence. When the convergence power begins to respond and the patient can attain 70 to 80 prism diopters of convergence, the minus lenses can be discarded.

*The Kinetic stereoscope.* This instrument can be moved in a rotary, vertical, horizontal, and oblique manner and the fusion can be trained in all fields. This makes for smooth coördination of the two eyes.

*Fixed stereoscope.* There are numerous charts for the stereoscope that are helpful. For children there are the Hamblin colored sets, Kroll, Dahfield, Dvorrine, Keystone Stepping Stones and the variety of home-made charts.

The synoptophore is always used at every period for perhaps 20 to 30 minutes, followed by exercise on the accessory instruments such as the stereoscope, Kinetic stereoscope, Rotoscope, and prism exercise.

The patient is given prism exercises for daily home training twice daily, with the prism base out. If the exophoria be greater for near than it is for distance and the Pc. is remote, exercises with the prism base out as high as the patient will accept are given, with fixation of a light at 33 cm. as well as at six meters in the office.

In directing prism exercises with children, if there is any suspicion of suppression, a red glass is placed over one eye and a green glass over the other and the prism exercises are done in this way in order to overcome the suppression. Place the red glass over the eye that is the one suspected of suspension of vision. It is too expensive for the patient to obtain a red glass for this purpose and too awkward for a child to hold a piece of red kodaloid paper before one eye while doing the exercise. We have found the simplest and most inexpensive method of handling this problem is to take a pair of ordinary smoked glasses, removing both lenses and placing over one eye a piece of red kodaloid paper cut to the size of the frame, fastening it securely by means of red cellophane adhesive.

Pin-convergence exercises are also prescribed for adults whose Pc. is abnormally remote. The same kind of exercise for home use is given to children, substituting a very small toy, such as the small German toys not more than an inch high. This is mounted on a wooden applicator. A child has no interest in a white-headed pin but will coöperate if given a small toy to take home for the purpose.

### EXOPHORIA DUE TO DIVERGENCE EXCESS OR TO DIVERGENCE EXCESS COMBINED WITH CONVERGENCE INSUFFICIENCY

Even though the convergence be normal in a good many cases of divergence excess —and sometimes the convergence is exceptionally high—convergence exercises are given in the same way as described for a convergence insufficiency, in the hope of still further increasing the convergence and reducing the divergence. Fusional divergence exercises are also stressed. If the patient learns to maintain fusion while diverging to a considerable degree, he may prevent one eye from wandering out. Exercises with prisms base out, fixating a light at 6 meters, are also given.

Exophoria due to divergence excess with a normal convergence and Pc. is less amenable to orthoptic treatment than exophoria due to convergence insufficiency. A certain percentage can be benefited, however, and some patients cured.

### ESOPHORIA

Experience seems to indicate that a predominance of such cases occur as a result of convergence excess.

In those cases due to divergence insufficiency, care must be taken to eliminate the possibility of a paresis of an abductor. Study of the esophoria in the different directions of the gaze, that is, the study of the "White card" and of the rotations, should eliminate this. Such study will often eliminate the possibility of paresis of an adductor associated with a comitant esophoria, great enough to overcome the divergence due to the insufficiency of the adductor. The ordinary type of esophoria is of accommodative origin.

An esophoria which increases notably

in near vision is most probably an anomaly of convergence.

We have noted children who were poor at athletics (baseball, tennis, and such games) requiring quick coördination of the eyes. Esophoria slows down the vision particularly for distance. As a result, these patients will avoid such games.

Esophoria is dangerous in air pilots for the same reason. The United States Military Academy is very strict in this, permitting a maximum of 10 prism diopters of esophoria for distance, beyond which they are not admitted. Candidates for the Flying Corps of the U. S. Army are rejected if they have more than 4 prism diopters of esophoria for distance.

In this way, since esophoria is more likely to be symptomatic in distance vision, the physical development of the child is materially hampered.

Very careful testing at several sittings at different times of the day, when the child is tired and when he is rested, are necessary to demonstrate the condition. A cure without glasses is desirable because the glasses will prevent his development almost if not quite as much as the esophoria. Furthermore he cannot enter the armed services wearing glasses. The social handicap in girls is of moment, together with the previously mentioned factors.

### SYMPTOMATIC ESOPHORIA

The same circumstances causing a symptomatic exophoria may operate to cause an esophoria. If there be present a comitant esophoria it may be accentuated. Thus a debilitated person may force his accommodation in trying to read and cause an esophoria or magnify a comitant esophoria already present. Obviously, as is so well known, those convalescent from an illness should not indulge in close work. Under such conditions a spasm of the convergence may develop which is usually, though not necessarily, associated with spasm of the accommodation.

Primary accommodative spasm of convergence is most frequently due to hysteria and when severe may simulate bilateral paralysis of the lateral recti. Rotations with one eye covered easily distinguish it. It may be produced by irritative lesions of the brain, reflex irritation from diseased teeth, or increased labyrinthian pressure, and allied conditions. The nasal accessory sinuses should be given careful consideration, as was suggested in discussing exophoria.

The orthoptic treatment of symptomatic esophoria is obviously not of great value. In some cases in which the fusion is weak it is a barometer of the patient's condition of health. When the individual is well there are no symptoms; when fatigued or not well, the symptoms appear or are exaggerated. Hence, as age advances and the patient is less well and less vigorous the symptoms of esophoria appear when they were perhaps not present, or but mildly, before. In cases with low divergence power, divergence exercises may be tried. In our experience they are rarely of value. The logical treatment is to study the case carefully and remove the cause.

### ESSENTIAL ESOPHORIA

One may make observations similar to those made upon this form of exophoria. The characteristic of essential esophoria is that it is uninfluenced by correction of the refraction, by exercises, or by symptomatic treatment. In some cases there are no symptoms; in some, mild symptoms; and in some, symptoms so severe as to produce incapacity for work. If the case is symptomless it is severely let alone and care is observed not to mention the presence of such an imbalance to the patient.

With symptoms *due to the esophoria*, and one should be sure they are due to

it, treatment should be at once instituted. Sufficient and painstaking study and observation, however, should be made to determine what treatment is indicated. If treatment is unavailing, surgery should be considered. Only after careful study and assured diagnosis is this safe. When one has completed such study and observation and determined upon operation, equally careful consideration should be given the operation of choice. Should it be upon the convergence system or upon the divergence system? We always treat the convergence system with great respect. If however there is a convergence excess without marked divergence insufficiency, modification of the excess of convergence is indicated. Tenotomy of the median rectus is, in our opinion, no longer permissible and is dangerous surgery. Jameson[5] has given us the ideal operation for modification of the power of the median rectus. It is what has been sought for years, a guarded tenotomy. It is simple, safe, and easily performed. Having this valuable addition to our methods we can now safely and securely modify the convergence without danger to this important function.

It is our experience that almost as much recession has to be provided in essential esophoria as in convergent squint. We recess but one muscle at a time and then wait for a period of several months before recessing the fellow median rectus, in order to give the eyes time to become fully stabilized following the first operation. The greatest care is taken not to weaken the convergence too much. For one or two years after the operation we test the convergence near point and the prism convergence to determine if the convergence is normal; also to determine if there is any residual esophoria and of what degree and *if there are symptoms.* Even though esophoria is present the symptoms are frequently relieved. If this is so, the remaining esophoria is ignored.

It is not uncommon to have a case in which there is a reduction from 20 to 30 prism diopters of esophoria to 10 to 15 prism diopters with complete relief of symptoms following operation. Such cases should be kept under observation for several years, since the esophoria tends to increase following the immediate effect of the operation.

The longer the esophoria has been in existence the more likely it will be found to have developed beyond a mere anomaly of the convergence, and changes may occur in the median and lateral recti. Obviously it is more difficult to cure.

Symptomatic esophoria in children and young adults should be cured without prescribing the continuous use of glasses, if it is possible. The handicap of the continuous wearing of glasses by youths and some young adults is very great. It may be greater than the esophoria.

### ESOPHORIA DUE TO REFRACTIVE ERRORS

Correction of myopia frequently increases existing esophoria but the patient may have asthenopia from the myopia unless glasses are worn. Since the patient is unable to see clearly without glasses and will probably wear them a large part of the time, decentering or the use of prisms incorporated in the lenses may be of value. Without myopic glasses the esophoria may not cause symptoms. Reduction of the strength of the glasses for near work may be indicated.

As to hypermetropic eyes, it is the opinion of most, if not all, ophthalmologists that full correction should be given.

This again brings up the question of the continual use of glasses, particularly in children and adolescents. Having worn a full hypermetropic correction, the patient can never be without them and he has of necessity to wear his glasses continually the remainder of his life. *He*

*may be cured of the esophoria provided it is of accommodative origin.* In the opinion of many patients the cure is worse than the esophoria. While this may not coincide with the opinion of the surgeon, it is a point of view that should be given consideration.

Orthoptic exercises may help here by dissociation of the convergence-accomodation function, by the stimulation of fusion, but rarely does it increase the divergence power.

Esophoria is probably produced in young children by excessive use of the eyes for near work. They must of necessity hold the reading matter too close to their eyes on account of their short arms. This habit, once formed, persists even when the arms grow longer. This is probably the explanation why many young people hold the book so close. It predisposes to convergence excesses and myopia and may explain this combination. The esophoria develops first and later the myopia.

### ANISOPHORIA AND HIGH HYPERMETROPIA

Anisophoria and high hypermetropia require proper correction combined with orthoptic treatment. The result is usually satisfactory.

### SENILE ESOPHORIA

Rarely an esophoria due to senility is encountered. It is usually of paretic origin due to nuclear degeneration or vascular disease.

One observes that esophoria becomes more symptomatic as age advances. An imbalance of 6 to 10 prism diopters may cause no marked symptoms in those under 35 or 40 years of age. In late life, however, the symptoms may be marked. It is better therefore by careful diagnosis to ascertain the type of esophoria with which we are dealing, particularly in youth. We may thus adopt the proper treatment and endeavor to cure the imbalance rather than merely mitigate the symptoms.

### ESOPHORIA AND ENDOCRINE DYSFUNCTION

The same general remarks made under exophoria in this category apply in esophoria. In thyroid dysfunction a comitant esophoria may become highly symptomatic due to the disturbed nervous system.

In the marked cases and particularly the later stages of exophthalmic goiter, numerous imbalances of the extraocular muscles may be present, including esophoria. Such imbalances are frequently due to paresis of, or to organic changes in, the muscles.

The value of orthoptic exercises is doubtful. When the patient has become stabilized, they may be of assistance in selected cases. After stabilization carefully considered surgery is more likely to be of value.

In gonadal disturbance an esophoria becomes highly symptomatic, and active treatment becomes necessary in conjunction with proper hormone therapy.

The possibilities of orthoptic treatment should be first exhausted, then promptly followed or combined with surgery, where this is indicated. Much could be said on this subject of disturbance of other parts of the endocrine system. The ocular system plays an important role in their symtomatology.

### ESOPHORIA IN PRESBYOPIA

Esophoria tends to become more marked and symptomatic as presbyopia sets in, probably due to the greater accommodative effort. It is here that proper glasses are of the greatest value. It frequently requires bifocals before they would otherwise be necessary. We again encounter the dislike on the part of the patient to the continuous wearing of glasses. Under such circumstances, more emphatic recommendations may be justi-

fiable. Stabilizing exercises with the synoptophore and stereoscope or similar instruments may be helpful.

It may be that the patient would prefer surgery, should this be indicated, to the continuous wearing of glasses. He should be given such a choice if there be one.

As a whole, the disturbances resulting from the onset of presbyopia are less in esophoria than in exophoria.

### ESOPHORIA RESULTING FROM DISTURBANCES OF THE CENTRAL NERVOUS SYSTEM

The remarks under the subject of exophoria largely obtain in esophoria. One may reiterate the necessity of recognizing the origin of the esophoria when it is due to disturbance of the nervous system either organic or functional.

Spasm of convergence is more likely to occur in hysteria. True spasm is overaction due to excess innervation. It is usually associated with spasm of the accommodation but not always. The pupils may be contracted.

Divergence paresis or paralysis may offer some difficulties in diagnosis. In this condition the esophoria is great for distance, none for near. The esophoria is the same in all directions of the gaze and rotations of both eyes together and of each eye singly are normal. The treatment is directed to the cause of the disturbance of the divergence. This is a neurological problem and cannot be discussed here.

### EXPERIENCE WITH ORTHOPTIC TREATMENT OF ESOPHORIA

The esophorias respond less readily to orthoptic treatment than do the exophorias.

Twelve cases of esophoria were treated, nine of which were in adults, the other three being in adolescents. Cases of esophoria that were once squints and were reduced to a phoria by surgery, orthoptics, or both are not included in this series. Out of the 12 cases of esophoria treated, only one showed reduction of the esophoria with disappearance of symptoms following orthoptic exercises. This was the case of a midshipman at Annapolis whose esophoria measured 8 prism diopters for distance and 2 prism diopters for near. He was given a +0.50 D. sph. ⊂⊃ +0.25 D. cyl. ax. 90° in each eye for near work only. The boy was having some discomfort and was afraid of failing his yearly physical examination because of the degree of the muscle imbalance. Orthoptic exercises reduced his esophoria to 3—4 prism diopters for distance and to orthophoria for near, with total disappearance of symptoms. He came daily for synoptophore exercises for 10 days.

Out of the 12 patients treated, the one case cited was the only one to show definite reduction of the esophoria and symptoms. Four cases showed complete disappearance of symptoms, but the esophoria remained the same. The symptoms were therefore probably not due so much to the esophoria as to binocular instability. With the stimulation of the fusional coordination the patient became comfortable.

Three of the twelve cases just mentioned were of neurotic patients, so that it is undecided whether stimulation of the fusion helped them or whether the improvement was psychic. One patient showed improvement of symptoms and comfort as long as home exercises plus synoptophore exercises at the office were continued, but there was no freedom from symptoms unless these were kept up. This patient was finally operated upon. The twelfth case showed no improvement of any kind.

*Technique in the treatment of the esophorias:* With the instrument set at the esophoric deviation, two stereograms are inserted and the arms of the synoptophore

are diverged until fusion breaks. The patient is requested to make concentrated mental effort to regain fusion at this point. If this is impossible the instrument is moved back toward the primary position until fusion is reëstablished. When the patient has attained good fusional divergence, convergence exercises are also given to secure fusional amplitude and to maintain the proper relationship between accommodation and convergence.

The Remy separator is used and the patient asked to make the mental effort to diverge his visual axes in order to view the charts as fused. The French school of orthoptics advises the use of the diploscope and the Remy separator.

The Keytone "Base In" set with a small hand stereoscope can be used for home training plus the synoptophore exercises at the clinic.

HYPERPHORIA

This is due in the majority of instances to insufficiency (paresis) of an elevator or depressor. The etiology is in doubt. The etiological relation to the lateral phorias is important. By some of the most experienced ophthalmologists it is thought to have a distinct bearing on the causation of a lateral imbalance. Given a low degree of esophoria or exophoria, the vertical imbalance so disturbs fusion that the lateral imbalance cannot, or at least can only with great effort, be compensated. Hence, it tends to increase through inability to fuse. This may progress to a squint. On this hypothesis, which we are disposed to accept, the vertical imbalance should be first corrected when a hyperphoria is demonstrable in the routine refraction of the patient. It is well to study it carefully. A "White" card should be made; that is, the muscle balance should be studied in the nine positions previously discussed and set down upon the card. We may then study the muscle or muscles which are paretic and arrive at a proper diagnosis.

There is not rarely a double hyperphoria, which the foregoing study will demonstrate.

In the phorias we may treat such vertical deviations as comitant in most cases; in fact, the low degrees of hyperphoria are usually comitant.

There is a strong element of spasm, since the hyperphoria may vary in degree, disappear, or increase at different sittings. Care should be observed that the patient's head is straight during the examination. The trial frame should be perfectly adjusted, particularly if strong correcting lenses are worn, since a hyperphoria may be produced if adjustment is incorrect.

Due regard should be paid the etiological factors discussed under exophoria and esophoria, with particular regard to diseases of the nasal accessory sinuses and reflex irritations.

Refractive errors bear a distinct etiological relation, since correction of such errors sometimes causes disappearance of the hyperphoria.

Endocrine dysfunction and central-nervous-system disorders should also be considered.

*Treatment:* The treatment is important since hyperphoria may produced marked asthenopia. There are cases, however, which are asymptomatic, and in these, as a rule, no effort is made to correct the hyperphoria.

Orthoptic exercises are of distinct value in many cases, using the synoptophore, rotoscope, or similar appliances.

Incorporation of prisms in, or decentering of, the lenses is often the easiest method for the surgeon of correcting, not curing, the hyperphoria. It is well to bear in mind that this is symptomatic treatment only. It is not meant to detract from its usefulness but by this means there is no cure of the hyperphoria. Furthermore, it necessitates the wearing

of glasses probably continuously, which is distasteful to many patients and some refuse to do so. Even so, it is the usual method of correcting the imbalance. Such method of treatment is inapplicable to an ever-increasing class of people; namely, aviators, our armed services, and others. In such cases, cure, not mere amelioration of symptoms, is not only desirable but necessary. Orthoptic treatment should be given a faithful trial. A certain number will respond. In those not responding to orthoptics, surgery is the method of last resort. The Air Corps of the Army and Navy permit a maximum of 0.75 D. of hyperphoria, except in the case of qualified fliers when 1 D. will be allowed. Manifestly, it is difficult to correct such small degrees of hyperphoria by surgery. Tenotomy of an elevator is scarcely permissible; partial tenotomy rarely accomplishes its purpose. The O'Connor cinch operation would seem to offer a means of cure.

CYCLOPHORIA

Symptoms resulting from cyclophoria are rare or possibly rarely recognized. It is my impression that the average ophthalmologist does not routinely test for cyclophoria. The commonest form of cyclophoria is that following the correction of astigmatism, particularly of higher degrees. Patients who have not had such correction and are given it for the first time often complain quite bitterly of distortion. Right angles are no longer rectangular, books are distorted in shape, tables appear tipped, floors not level, and so on. This may be very disturbing to the patient. Tests may demonstrate a cyclophoria.

Before the advent of the synoptophore it did not seem practical to attempt treatment of the cyclophoria, since it usually gradually disappeared in a few days to a fortnight. Explanation of the cause of the symptoms, usually difficult, was attempted and the patient was assured that as soon as he had become accustomed to the new glasses the symptoms would disappear. Such explanations are unsatisfactory to the patient and to the surgeon. Some of the patients continued with their symptoms and the astigmatic correction had to be reduced or removed.

We have in the synoptophore and similar instruments, a means of logical and successful treatment of this condition. A few seances with this instrument suffice to remedy the situation, much to the gratification of all concerned. Surgical measures do not seem applicable and should not be considered for this form of cyclophoria.

*Orthoptic treatment of cyclophoria:* We occasionally see a cyclophoria that is not more than of 5 degrees when measuring the patient before the synoptophore. The synoptophore seems to be the best instrument for measuring it accurately. In our experience we have observed no more than 5 to 8 degrees of cyclophoria, except in one case.

The patient with esophoria is more likely to manifest a cyclophoria than a patient with exophoria. Sometimes the cyclophoria is due to the correction of the refractive error or results from tilting of the correcting lens. This occurs more frequently when a patient is wearing correction for a high astigmatic error; that is, strong cylinders. Patients should be tested for cyclophoria with and without glasses.

*Method of examination:* Clark disc and red cross are used. Check with Clark straight lines. The lines are separated, giving the patient diplopia, and he is asked if the lines are exactly parallel or if one or both are tilted. If so, the lines are straightened and the amount of cyclophoria, plus or minus, read from the scale. The lines are then put into position where fusion is possible and if the patient can

fuse he will see one straight line with a dot on either side, the control marks for suppression. The synoptophore measurement can be checked by the Maddox double prism.

One case of high cyclophoria was seen. It was interesting to note that the defect responded rapidly to exercise. The patient was an adult with a right fourth-nerve paresis. His synoptophore measurements were + cyclophoria of 20 degrees of the left eye; right hyperphoria of 9 prism diopters and no convergence. He could hold fusion at balance or orthophoria with the cyclophoria and hyperphoria corrected, but could not converge. His cyclophoria was first treated; when it began to reduce, the convergence was exercised. As the cyclophoria decreased, so did the hyperphoria, and the convergence increased. At the end of nine orthoptic periods he measured cyclophoria +10 and right hyperphoria 1½ with a convergence of 60. prism diopters on the synoptophore.

### BINOCULAR INSTABILITY (Weak Fusion)

Cantonnet[6] says "binocular instability runs in the streets."

A great many cases of binocular instability are seen in the adult, sometimes associated with a phoria, sometimes with beginning presbyopia, and sometimes merely as a result of weak fusion.

The synoptophore, the telebinocular, and the kinetic stereoscope are used in such cases to advantage. Fusional divergence and convergence exercises are given. The telebinocular is particularly valuable for this type of case.

Binocular instability manifests itself in constant breaking of the fusion. The patient may show a good fusional amplitude in the primary position at one moment and at the next moment constant breaking and regaining of his fusion. In other fields than the primary he will also show erratic fusion. In changing fixation, requiring different amounts of fusional divergence and convergence, his fusion is slow and requires mental effort. In most cases fusional coördination in all fields is rapidly achieved by orthoptic exercise.

### SPASM OF ACCOMMODATION IN HYPEROPIC SUBJECTS DUE TO THE WEARING OF MYOPIC GLASSES

Two cases were seen, both in young women who were wearing myopic glasses although they had a low hyperopia. The myopic glasses were discarded in each case following a cycloplegic examination. Both young women complained of the same symptoms when first seen; that is, "mistiness" of vision and a feeling of "squinting," with or without the myopic correction. Exercises were given on the synoptophore with plus lenses (from +1.00 to +3.00) in front of the eyes to relax the accommodation, while the usual fusion exercises were being carried out. Both patients showed an instability of fusion, but after exercise with the plus lenses the fusion became steadier, and good coördination of the eyes was achieved with keen stereopsis and total absence of symptoms.

### DIVERGENCE EXCESS ASSOCIATED WITH CONVERGENCE EXCESS

S. S., aged 19 years, complained of headaches, nausea, glasses uncomfortable, and inability to do her school work for two years. The physical examination was negative.

The patient had 12 diopters of exophoria at 6 meters and 9 diopters of esophoria at 33 cm. The vision was 20/15 in each eye. She accepted +0.50 D. sph. in each eye under homatropine. No glasses were ordered. The patient was suffering from a divergence excess associated with convergence excess. At a distance

the exophoria manifested itself and caused trouble in her ability to keep her images fused. At the near point her convergence was excessive so that she had an esophoria of 9 prism diopters, which annoyed her.

She was given exercises on the synoptophore, using +2.50 to +3.00 spheres to inhibit her accommodation while converging. Divergence exercises without any glasses were also given her on the same instrument. At the distance, she was given prism convergence exercises, base out, for several periods but this was later omitted as it was found to increase her esophoria. Following each exercise period she was carefully measured for near and distance with the Maddox Rod and the cover test for fear that esophoria had been increased by the convergence exercises and exophoria by the divergence exercises. If the measurements showed any indication that the exercises had stimulated either of these functions in the wrong direction, she was again placed at the synoptophore and given exercises to neutralize this. In this way an endeavor to keep an even balance between the two functions was carefully watched. The exercises stimulated her fusion sense and were probably a valuable factor in stabilizing her eyes and reducing her symptoms.

After 11 exercise periods she developed a left hyperphoria as follows:

M.R. Distance L.H. 1½ Near ½ L.H.

At this period her prism convergence was 80 prism diopters and divergence 14 prism diopters at 6 meters. She had no symptoms at all for near but still some slight discomfort at a distance. The left hyperphoria disappeared after two or three weeks. She had nine weeks of exercise and was dismissed with a final measurement of exophoria 1 prism diopter for distance and balance for near. The Pc. was 4 cm. Prism convergence at 6 meters was 70. There was entire relief of symptoms.

STEREOPSIS

We have seen several instances of young men wishing to enter the Service in the Air Corps of the Army and Navy who have been refused entrance because of faulty depth perception. The tests given in the Services for the perception of depth are made at 6 meters. This is not a test for stereopsis, as stereopsis applies to the cerebral fusion of two images not absolutely alike that are superimposed upon each other to give the illusion of relief. Tests for stereopsis are made on the various orthoptic instruments using charts to form this illusion. The tests for depth perception are actually measurements of the distance between two objects. The Dolman-Howard test at 6 meters is the generally accepted test in the Services at the present time. The terms depth perception and stereopsis should not be confused.

Upon examination on the synoptophore, several of the cases referred to manifested inaccurate or absent stereopsis when the instrument was set at orthophoria or when the axes of the eyes were parallel and accommodation at rest, but manifested keen stereopsis as soon as accommodations and convergence were used. As the arms of the instrument were pushed toward orthophoria again the picture would gradually flatten.

Several authors have attempted to explain why a patient has no perception of relief when the visual axes are parallel and accommodation at rest. Cantonnet[6] says: "Accommodation may give some rough indication as to the distance of objects, as when we look at a distant object we accommodate but little or not at all, and it is natural to think that in so far as we can judge of the degree of our accommodation we can derive some information as to the distance of the object

viewed. In the normal observer the functions of accommodation and convergence play an important part. Experience teaches us to establish a relation between the state of our eyes and the distance of objects viewed. Therefore it is not directly, but by the intermediary of an established relation, that normal individuals recognize distance in terms of the accommodation and convergence they exert."

In an attempt to overcome such faulty depth perception, this small group of patients was given training. Stereoscopic charts were placed in the synoptophore at the angle of convergence where the picture was in sharpest relief and the arms of the instrument gradually pushed toward orthophoria. At first the illusion of relief would gradually flatten and disappear when it reached orthophoria but with training and concentration several of these patients learned to maintain the stereoscopic effect at orthophoria and even when diverging the visual axes.

The telebinocular was also used, with the aim to hold the stereopsis at 00 or infinity.

The necessity for stereoscopic vision is becoming greater every year. Aviation, finger-print work, stereoscopic map drawing, projecting machines, and many other instruments and appliances bring this to our attention.

Poor stereopsis may be the result of an esophoria or exophoria or weak fusion. In such cases fusion exercises are of great value, combined with stimulation of the convergence or divergence as the case may be.

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# MEASUREMENT OF THE ANGLE OF MAXIMUM CONVERGENCE

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A method is offered of determining maximum convergence by measuring the angle formed by the inward deviation of the eye as it fixates the near point, and the base line connecting the centers of rotation. This does not measure total convergence power because no account is taken of any preliminary deviation from parallelism of visual axes in the position of rest, but it does actually measure the true angle of convergence more accurately than does the usual method, which consists in measuring the angle W (see diagram).

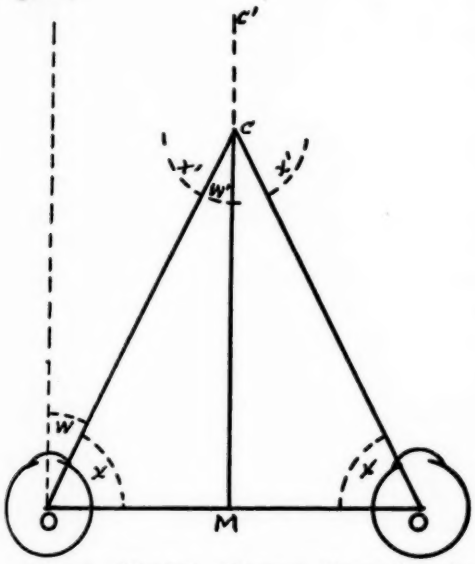


Fig. 1 (Martin). Diagram illustrating the measurement of the angle of maximum convergence.

If the visual axes at rest are not parallel, the test by the method described by Fuchs (Ed. 5, p. 722) is incorrect to the extent of the difference of convergence or divergence from parallelism.

In the figure, the point C marks the point of maximum convergence, and the base line OO connects the centers of rotation. These two lines form the right angle OMC. The length of the line OC determines the size of the angle X, or the unknown. The length of the lines OM and CM is measurable and determines the tangent of the angle X. This expression can be converted into degrees and minutes and then into meter angles. This gives a mathematical expression to the amount of convergence in relation to the base line without regard to assumed parallelism in the position of rest.

The former method is measured on the sine of the angle. It is really a measurement of angle W or W′, defining maximum convergence on the assumption that the visual axes are parallel in the position of rest. The formula for this determination is fully set forth in standard texts.

The base line OO, or interpupillary distance, may be measured by the pupillometer or by any of the usual methods commonly used for the determination of this distance. The line CM may likewise be measured with a centimeter rule or other special device.

An instrument has been constructed to facilitate the measurement of the base lines and the point of maximum convergence. It will be described more fully in a subsequent paper. Essentially, it consists of three parallel rails carrying test objects that are movable toward and away from the eyes being tested, the rails being calibrated for reading the end point of the tests. Plano lenses, with scratch marks at right angles and intersecting at the lens centers, are mounted in carriers on the rails and placed in close proximity to the eye. The position of the rails is adjustable, so that the zero marks are in perpendicular line with the anterior corneal surfaces. Sighting along the rails from

the far end and towards the patient's eye, the exact center of the lenses is made to correspond with the exact center of the pupils by means of fine adjustments for that purpose affixed to the rails. A removable plate having slotted grooves marked in millimeters is then placed astride the middle rail, its base resting upon the lateral rails in contact with the lens carriers. The scratch marks are visible through the slots and the interpupillary distance is easily read.

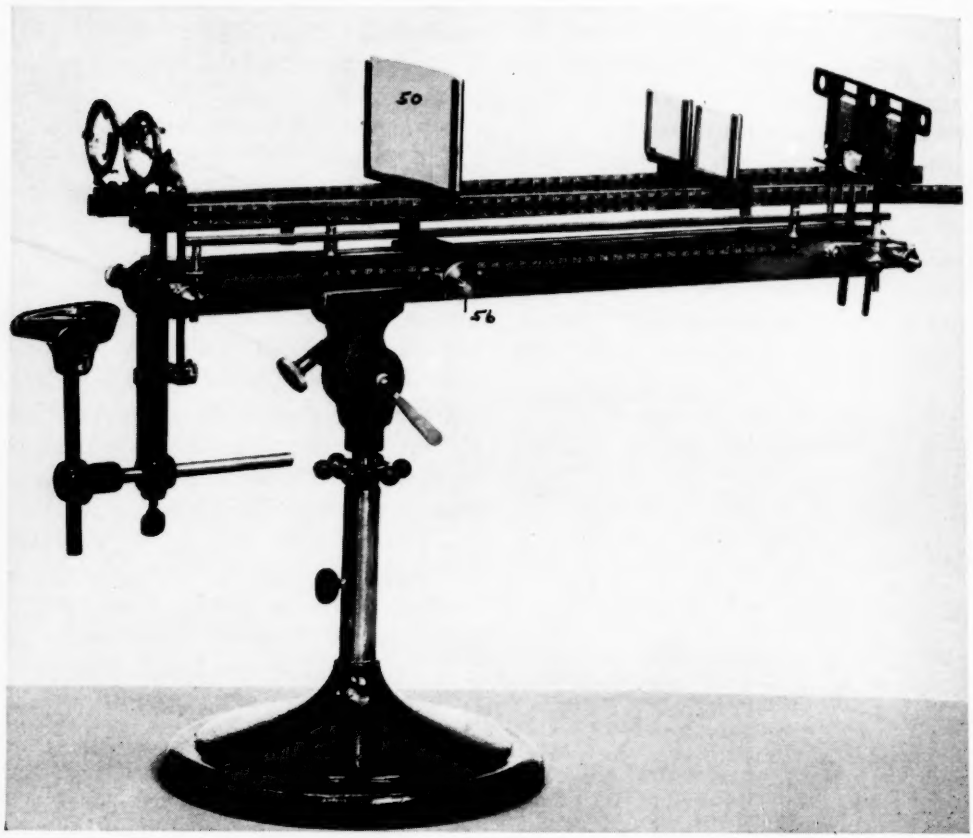


Fig. 2 (Martin). Instrument for measuring base lines and the point of maximum convergence.

To determine the distance CM, the middle scale, also marked in centimeters, is adjusted to correspond exactly with the markings on the lateral rails. The plate having been removed, the test object (50 in fig. 2) is advanced toward the eyes (by means of screw 56 operating an endless chain to which the test object is fixed through a slot) until the test object doubles. This point is read off in centimeters on the middle rail and is the measure of the line CM. The instrument is adjustable in every direction and serves other purposes of near-muscle-function examination as well. A special advantage consists in the reading of convergence at any near distance up to 60 centimeters, readily convertible into meter-angle terms.

Having determined the known factors, the formula $\frac{OM}{CM}$ gives the tangent of the angle X. This expression is converted into degrees and minutes most readily by referring to a standard table commonly

METER-ANGLE CHART 1

Distance in cm.

| Pd. in mm. | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | 9.5 | 10.0 | 10.5 | 11.0 | 11.5 | 12. | 13. | 14. | 15. | Pd. in mm. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 16. | 14.72 | 13.45 | 12.7 | 11.9 | 11.1 | 10.5 | 9.9 | 9.4 | 8.9 | 8.5 | 8.1 | 7.8 | 7.4 | 7.1 | 6.6 | 6.1 | 5.8 | 56 |
| 57 | 16.2 | 14.9 | 13.8 | 12.9 | 12.09 | 11.3 | 10.7 | 10. | 9.54 | 9. | 8.72 | 8.2 | 7.9 | 7.6 | 7.2 | 6.7 | 6.2 | 5.9 | 57 |
| 58 | 16.4 | 15.1 | 14. | 13.1 | 12.2 | 11.5 | 10.8 | 10.1 | 9.7 | 9.2 | 8.8 | 8.4 | 8.0 | 7.7 | 7.3 | 6.9 | 6.3 | 6.0 | 58 |
| 59 | 16.6 | 15.36 | 14.2 | 13.3 | 12.4 | 11.72 | 11. | 10.3 | 9.9 | 9.4 | 8.9 | 8.54 | 8.1 | 7.9 | 7.5 | 7.0 | 6.5 | 6.1 | 59 |
| 60 | 16.9 | 15.6 | 14.5 | 13.5 | 12.6 | 11.9 | 11.2 | 10.6 | 10. | 9.59 | 9.0 | 8.7 | 8.2 | 8.0 | 7.6 | 7.1 | 6.6 | 6.2 | 60 |
| 61 | 17.1 | 15.8 | 14.72 | 13.7 | 12.8 | 12.09 | 11.3 | 10.8 | 10.1 | 9.7 | 9.2 | 8.8 | 8.3 | 8.1 | 7.8 | 7.2 | 6.7 | 6.28 | 61 |
| 62 | 17.3 | 16. | 14.9 | 13.9 | 13. | 12.2 | 11.5 | 10.9 | 10.3 | 9.9 | 9.4 | 9.0 | 8.5 | 8.2 | 7.9 | 7.3 | 6.8 | 6.36 | 62 |
| 63 | 17.5 | 16.3 | 15. | 14.1 | 13.2 | 12.45 | 11.7 | 11. | 10.5 | 10. | 9.5 | 9.1 | 8.6 | 8.3 | 8.0 | 7.4 | 6.9 | 6.45 | 63 |
| 64 | 17.8 | 16.45 | 15.2 | 14.2 | 13.4 | 12.63 | 11.9 | 11.1 | 10.7 | 10.1 | 9.7 | 9.2 | 8.8 | 8.4 | 8.1 | 7.5 | 7.0 | 6.54 | 64 |
| 65 | 18. | 16.7 | 15.5 | 14.4 | 13.6 | 12.81 | 12.1 | 11.3 | 10.9 | 10.2 | 9.8 | 9.3 | 9.0 | 8.6 | 8.2 | 7.6 | 7.1 | 6.63 | 65 |
| 66 | 18.2 | 16.9 | 15.7 | 14.6 | 13.8 | 13. | 12.2 | 11.5 | 11. | 10.4 | 10.0 | 9.5 | 9.1 | 8.7 | 8.3 | 7.7 | 7.2 | 6.7 | 66 |
| 67 | 18.4 | 17.1 | 15.9 | 14.8 | 14. | 13.1 | 12.3 | 11.7 | 11.1 | 10.5 | 10.1 | 9.6 | 9.2 | 8.9 | 8.4 | 7.8 | 7.3 | 6.82 | 67 |
| 68 | 18.8 | 17.3 | 16. | 15. | 14.2 | 13.2 | 12.4 | 11.9 | 11.2 | 10.7 | 10.2 | 9.8 | 9.3 | 9.1 | 8.6 | 8.0 | 7.4 | 6.9 | 68 |

Distance in cm.

| Pd. in mm. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. | 26. | 27. | 28. | 29. | 30. | 31. | 32. | 33. | Pd. in mm. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 5.45 | 5.09 | 4.81 | 4.54 | 4.36 | 4.18 | 3.9 | 3.77 | 3.59 | 3.5 | 3.31 | 3.21 | 3.09 | 2.95 | 2.9 | 2.8 | 2.72 | 2.63 | 56 |
| 57 | 5.54 | 5.18 | 4.9 | 4.63 | 4.45 | 4.27 | 4.0 | 3.81 | 3.63 | 3.54 | 3.36 | 3.27 | 3.13 | 3.04 | 2.95 | 2.86 | 2.77 | 2.68 | 57 |
| 58 | 5.63 | 5.2 | 5. | 4.72 | 4.54 | 4.31 | 4.09 | 3.9 | 3.72 | 3.63 | 3.45 | 3.31 | 3.18 | 3.09 | 3.0 | 2.9 | 2.81 | 2.72 | 58 |
| 59 | 5.7 | 5.3 | 5.09 | 4.81 | 4.63 | 4.36 | 4.18 | 3.95 | 3.81 | 3.68 | 3.52 | 3.36 | 3.27 | 3.13 | 3.04 | 2.95 | 2.86 | 2.77 | 59 |
| 60 | 5.8 | 5.4 | 5.18 | 4.9 | 4.72 | 4.45 | 4.2 | 4.0 | 3.9 | 3.72 | 3.59 | 3.45 | 3.31 | 3.22 | 3.09 | 3.0 | 2.9 | 2.82 | 60 |
| 61 | 5.9 | 5.5 | 5.27 | 5.0 | 4.78 | 4.54 | 4.27 | 4.09 | 3.95 | 3.76 | 3.63 | 3.5 | 3.35 | 3.27 | 3.13 | 3.04 | 2.95 | 2.86 | 61 |
| 62 | 6.0 | 5.6 | 5.36 | 5.09 | 4.81 | 4.59 | 4.3 | 4.13 | 4.0 | 3.81 | 3.68 | 3.54 | 3.45 | 3.31 | 3.18 | 3.09 | 3.0 | 2.9 | 62 |
| 63 | 6.1 | 5.7 | 5.45 | 5.18 | 4.89 | 4.65 | 4.45 | 4.22 | 4.09 | 3.86 | 3.77 | 3.6 | 3.5 | 3.36 | 3.27 | 3.13 | 3.04 | 2.95 | 63 |
| 64 | 6.2 | 5.8 | 5.54 | 5.27 | 4.94 | 4.72 | 4.5 | 4.31 | 4.18 | 3.9 | 3.81 | 3.64 | 3.54 | 3.45 | 3.31 | 3.18 | 3.09 | 3.0 | 64 |
| 65 | 6.27 | 5.9 | 5.63 | 5.36 | 5.0 | 4.81 | 4.54 | 4.37 | 4.22 | 4.09 | 3.86 | 3.72 | 3.59 | 3.5 | 3.36 | 3.22 | 3.13 | 3.04 | 65 |
| 66 | 6.36 | 6.0 | 5.72 | 5.45 | 5.09 | 4.86 | 4.63 | 4.45 | 4.27 | 4.13 | 3.9 | 3.77 | 3.63 | 3.54 | 3.4 | 3.27 | 3.18 | 3.09 | 66 |
| 67 | 6.45 | 6.09 | 5.81 | 5.5 | 5.18 | 4.9 | 4.72 | 4.54 | 4.32 | 4.18 | 3.95 | 3.81 | 3.68 | 3.59 | 3.45 | 3.31 | 3.22 | 3.13 | 67 |
| 68 | 6.54 | 6.19 | 5.9 | 5.54 | 5.27 | 5.04 | 4.81 | 4.6 | 4.36 | 4.22 | 4.09 | 3.86 | 3.72 | 3.63 | 3.54 | 3.36 | 3.27 | 3.18 | 68 |

used for that purpose, and then into meter-angle terms as shown in standard texts; that is, 1 degree, 50 minutes is equivalent to 1 meter-angle average.

Example: Suppose the base line OO is 60 mm., and the near point of convergence is 6 cm., $\frac{OM}{CM}$ or $30/60 = .5$; then the tangent reading for this figure is 26° 40′. Since an average of 1° 50′ represents 1M.A., 14.5 M.A. is the maximum convergence in this case.

To facilitate the examination in practice, chart 1 was compiled, showing meter-angle determinations for varying distances of the base line and PpC commonly encountered. In the first vertical column, the base line in millimeters is set forth, and reading horizontally above, the PpC in centimeters. If, for example, the base line is 60 millimeters and the PpC is 6 centimeters, the first vertical column is read down to figure 60 and then horizontally until it intersects the figure 6.0 shown at the top. In the space of intersection of these two columns, is the figure 14.5 which represents the meter-angle expression.

Chart 2 represents the measurement of angle W or W′ (the sine of the angle) and for purposes of comparison it will be noted that the closer the near point of convergence, the greater is the difference

METER-ANGLE CHART 2

Distance in centimeters

| Pd. in mm. | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | 9.5 | 10.0 | 10.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 18.54 | 16.72 | 15.19 | 13.9 | 12.9 | 12.0 | 11.18 | 10.54 | 9.9 | 9.36 | 8.90 | 8.45 |
| 57 | 18.9 | 17.0 | 15.50 | 14.18 | 13.0 | 12.18 | 11.36 | 10.68 | 10.09 | 9.54 | 9.0 | 8.59 |
| 58 | 19.34 | 17.32 | 15.72 | 14.45 | 13.27 | 12.37 | 11.63 | 10.86 | 10.27 | 9.68 | 9.18 | 8.72 |
| 59 | 19.72 | 17.72 | 16.04 | 14.72 | 13.54 | 12.63 | 11.81 | 11.04 | 10.45 | 9.90 | 9.36 | 8.91 |
| 60 | 20.00 | 18. | 16.36 | 15.0 | 13.80 | 12.86 | 12. | 11.45 | 10.63 | 10.0 | 9.54 | 9.04 |
| 61 | 20.54 | 18.27 | 16.68 | 15.27 | 14.09 | 13.09 | 12.27 | 11.54 | 10.81 | 10.22 | 9.72 | 9.22 |
| 62 | 20.90 | 18.72 | 16.93 | 15.54 | 14.36 | 13.36 | 12.45 | 11.63 | 11.0 | 10.40 | 9.90 | 9.36 |
| 63 | 21.36 | 19. | 17.27 | 15.81 | 14.63 | 13.54 | 12.63 | 11.86 | 11.18 | 10.54 | 10.09 | 9.54 |
| 64 | 21.72 | 19.36 | 17.54 | 16.09 | 14.90 | 13.77 | 12.9 | 12.04 | 11.36 | 10.72 | 10.18 | 9.68 |
| 65 | 22.09 | 19.72 | 17.90 | 16.36 | 15.09 | 14.0 | 13.09 | 12.27 | 11.54 | 10.90 | 10.36 | 9.81 |
| 66 | 22.45 | 20. | 18.22 | 16.63 | 15.36 | 14.27 | 13.27 | 12.45 | 11.72 | 11.09 | 10.54 | 10.0 |
| 67 | 22.90 | 20.45 | 18.54 | 16.90 | 15.63 | 14.45 | 13.54 | 12.68 | 11.90 | 12.18 | 10.72 | 10.18 |
| 68 | 23.45 | 20.54 | 18.81 | 17.22 | 15.9 | 14.72 | 13.72 | 12.86 | 12.09 | 12.36 | 10.90 | 10.27 |

| Pd. in mm. | 11.0 | 11.5 | 12.0 | 13.0 | 14.0 | 15.0 | 16.0 | 17.0 | 18.0 | 19.0 | 20.0 | 21.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 8.0 | 7.63 | 7.36 | 6.81 | 6.36 | 5.9 | 5.45 | 5.18 | 4.8 | 4.63 | 4.36 | 4.18 |
| 57 | 8.18 | 7.81 | 7.45 | 6.9 | 6.4 | 6.0 | 5.6 | 5.27 | 4.9 | 4.72 | 4.45 | 4.27 |
| 58 | 8.36 | 7.95 | 7.54 | 7.09 | 6.5 | 6.09 | 5.72 | 5.36 | 5.0 | 4.81 | 4.54 | 4.36 |
| 59 | 8.45 | 8.09 | 7.72 | 7.18 | 6.63 | 6.18 | 5.81 | 5.09 | 5.09 | 4.9 | 4.63 | 4.45 |
| 60 | 8.63 | 8.27 | 7.90 | 7.27 | 6.72 | 6.27 | 5.90 | 5.5 | 5.18 | 5.0 | 4.72 | 4.5 |
| 61 | 8.72 | 8.40 | 8.04 | 7.36 | 6.81 | 6.36 | 6.00 | 5.63 | 5.27 | 5.09 | 4.81 | 4.59 |
| 62 | 8.90 | 8.54 | 8.18 | 7.54 | 7.00 | 6.45 | 6.09 | 5.72 | 5.36 | 5.18 | 4.9 | 4.63 |
| 63 | 9.0 | 8.68 | 8.36 | 7.63 | 7.09 | 6.54 | 6.18 | 5.81 | 5.45 | 5.27 | 5. | 4.72 |
| 64 | 9.18 | 8.81 | 8.45 | 7.81 | 7.27 | 6.63 | 6.27 | 5.9 | 5.54 | 5.36 | 5.09 | 4.81 |
| 65 | 9.36 | 8.90 | 8.54 | 7.9 | 7.36 | 6.81 | 6.36 | 6. | 5.63 | 5.45 | 5.13 | 4.86 |
| 66 | 9.54 | 9.13 | 8.72 | 8.0 | 7.54 | 6.9 | 6.45 | 6.09 | 5.72 | 5.5 | 5.18 | 4.9 |
| 67 | 9.63 | 9.22 | 8.90 | 8.09 | 7.63 | 7.04 | 6.6 | 6.18 | 5.81 | 5.54 | 5.27 | 5.0 |
| 68 | 9.81 | 9.36 | 9.0 | 8.27 | 7.72 | 7.09 | 6.72 | 6.2 | 5.9 | 5.63 | 5.36 | 5.09 |

between the meter-angle expressions by the two methods. For instance, with a base line of 56 millimeters and a PpC of 5.0 centimeters the meter angle expression is 18.54 by the former method and 16 by the method proposed here. With a base line of 68 millimeters and a PpC of 5 centimeters there is a difference of 4.65 meter angles.

Obviously at only one point of C along the line CM would the line OC be of such length as to render angles X and W equal. Progressively less discrepancy obtains as the PpC is more remote. When a PpC of 21 centimeters is considered, the meter-angle expression is almost the same by each method. These are, of course, reciprocal angles and the value of each may be determined by knowing the value of one.

The use of the method of measuring maximum convergence here proposed over a long period of time has afforded a more representative and equitable means of determining this function and lends itself more readily to comparison with the accommodative function.

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# THE OCCURRENCE OF SO-CALLED DINITROPHENOL CATARACTS WITHOUT INGESTION OF DINITROPHENOL*

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As is well known, a number of cases of a toxic type of cataract associated with dinitrophenol therapy have been reported. As to history, the patients who developed these cataracts had numerous factors in common, and the cataracts themselves were similar in a number of ways. To summarize these briefly:

The patients were all women, all in an age group in which development of cataract as a senile phenomenon does not occur, all had good vision and normal eyes before the development of cataracts, and in most of them the formation of cataracts was quite rapid. Characteristically, the common factors ordinarily contributing toward cataract formation were not present, and the general physical condition was normal except for obesity.

The lens opacities often reduced visual acuity rapidly, On slitlamp examination the lenses showed fine anterior subcapsular opacities, sectorlike cortical opacities, clear nuclei, and golden posterior subcapsular opacities which were often somewhat fluorescent.

At the time of operation the lenses were found to be soft. Keratome incisions were made, and, following capsulotomy, the mushy lens substance could be expressed easily on one or two spoons, leaving a black pupil. The operative results were almost uniformly good.

The case presented is that of a woman, 23 years old, in whom the history, examination of the eyes, and response to cataract extraction correspond remarkably with the group described, with one outstanding exception—this patient had taken no dinitrophenol, although she had taken a product advertised as a reducing agent, "Slendrets." Two analyses by the Senior Chemist of the Division of Chemistry of the Department of Public Health in San Francisco showed that this product

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contained no dinitrophenol. It likewise contained no thyroid, salicylic acid, hexamethylenamine, phosphates, boric acid, nor sulphates. It was composed of dextrose (97.84 percent) and excipient (2.16 percent). The patient freely admitted the use of "Slendrets," was fully coöperative, and apparently truthful. She consistently denied the use of dinitrophenol or any other reducing agent except "Slendrets" during repeated interrogations by members of the ophthalmic staff and interested clinicians.

This case is of interest in that cataracts occurred coincident with the ingestion of a reducing agent which did not contain dinitrophenol. These cataracts were similar in every respect to those which occurred coincident with the ingestion of dinitrophenol.

### Case history

A white, married woman, 23 years old, was admitted for examination on January 5, 1937.

She had had no ocular troubles, except occasional hordeoli, until three weeks before her entry, had never worn glasses and had always seen well without them. There was no history of trauma to the eyes.

Four weeks before entry the patient began to take "Slendrets," a reducing agent. She took fourteen tablets daily for one week and lost only two pounds. At the end of this time (three weeks before entry) her vision began to diminish in both eyes. Two weeks before entry she noted considerable loss of vision and was forced to stop her work as a manicurist. During this time she had occasional aching pains over the eyeballs.

*Ophthalmic examination:* Vision, uncorrected, was O.D. ability to count fingers at four feet; O.S. ability to count fingers at six feet.

Vision, corrected with: O.D. —8:00 D. sph. ⊂⊃ +2:00 D. cyl. ax. 30° was 20/200; O.S. —6:00 D. sph., 20/100.

Lids, conjunctivae, corneae, anterior chambers, pupils, and irides were normal, except that the anterior chambers were shallow.

There were intumescent cataracts in both eyes showing the following structure by slitlamp microscopy: Fine web-like anterior subcapsular opacities, anterior and posterior cortices full of spires; clear nuclei; opaque posterior subcapsular regions, white appearing and not clearly visible.

Vitreous bodies and fundi were normal when examined after the cataract extraction. Extraocular muscles, intraocular tension, and visual fields were likewise found to be normal.

*General medical history:* Before her ninth year the patient had had measles, mumps, whooping cough, pneumonia, diphtheria, and smallpox.

Menarche occurred at the age of 14 years; menstruation is regular, for five or six days every twenty-eight days, with cramps; otherwise uneventful.

Marital. The patient was married at the age of fifteen years and lived with her husband for three years; pregnant five times, gravid twice. Three abortions were induced by means of vaginal packs, with the ingestion of at least ten quinine tablets each time. Twenty-four capsules of ergot were used on one occasion two years ago, none since. Daily douches are taken for vaginal discharge. The douche was prescribed by a physician and contained the following drugs:

| | |
|---|---|
| Oleo menthi | 2 |
| Phenol | 12 |
| Powdered alum | 40 |
| Boric-acid solution q.s.ad | 120 |

Sig: 1 dram to a quart of water

Traumatic. The patient suffered a fractured nose from a blow three years ago, and has subsequently had poor hearing in

the right ear. A fracture of the right maxilla was the result of an automobile accident. The eyes were not injured.

Occupational. The patient is a manicurist, uses various preparations, but none in great quantities, nor is she in actual contact with them. No depilatories are used.

Familial. The father is living and well at the age of 72 years; the mother died in childbirth. There are 10 siblings: one died aged six years "from eating green apples," the others are living and well. There is no family history of ocular disease.

*Systemic history:* Frontal headaches have come on towards the end of the day during the past few months.

Ears. The hearing is poor, more marked on the right side, following the automobile accident two years ago, with occasional tinnitus since.

Nose. Broken, as mentioned above.

Throat. There are frequent sore throats.

Teeth. Five teeth were extracted because of apical abscesses, November, 1936.

Heart. Normal.

Lungs. Pneumonia 2½ months before entry was the occasion for the ingestion of sufficient quinine to produce severe tinnitus and nausea.

Gastro-intestinal. Laxatives are taken: milk of magnesia, Ex-Lax, magnesium citrate, and enemas. Otherwise the tract is normal.

Genito-urinary. Four years ago the patient underwent a laparotomy for tubal pregnancy; two years ago suffered Bartholinitis and pelvic inflammatory disease.

Mental. An aphasic period occurred during January and February, 1936, durwhich time the patient had an almost constant fever of 104 degrees of unknown etiology. She was cared for by her sister during this time, and is certain that she took no reducing medicines. She has been subject to occasional fainting spells since, the last time in September, 1936.

*General medical examination:* Ears. There is impaired hearing bilaterally, more marked on the right.

Abdomen. An operative scar remains in the right lower quadrant. There was some hypogastric tenderness.

Pelvis. A left Bartholin cyst was found, with chronic cervicitis and chronic pelvic inflammatory disease.

Extremities were normal; Chvostek, Trousseau, and tourniquet signs, negative.

Neurological and mental examinations were negative for pathology; the reflexes and vibratory sense, normal.

Head, nose, throat, neck, skin, heart, and lungs were essentially negative for pathology.

Laboratory examinations: The urine was essentially negative. The blood count showed R.B.C., 4,450,000; hemoglobin, 85 percent; W.B.C., 9,000. The differential count revealed polymorphonuclears, 58 percent; lymphocytes, 36 percent; monocytes, 6 percent; blood Wassermann, negative; blood sugar, 121.6 mg. per 100 c.c.; blood calcium, 10.3 mg. per 100 c.c.; blood phosphorous, 3.9 mg. per 100 c.c.

Stool examination. No ova nor parasites were found; Occult blood, positive.

B.M.R., minus 15.6.

*Cataract extractions:* On January 6, 1937, the right eye was operated upon with a keratome incision and capsulotomy. The lens substance was found to be soft; the majority was expressed on one Hess spoon and the remainder on one more spoon, leaving a clear black pupil. Three days later the same procedure was followed on the left eye.

*Postoperative course* was entirely uneventful. With the following correction

the patient's vision was 20/15 in each eye: O.D. +13:00 D. sph. ⊂⊃ +1:25 D. cyl. ax. 90°; O.S. +11:00 D. sph. ⊂⊃ +2:75 D. cyl. ax. 72°. With the addition of a +3:00 D. sph. the patient read J 1 with both eyes.

*Consideration of pathogenic factors of cataract* and their bearing on this case:

Toxic causes: There was no history of exposure to either naphthalene or thallium. No depilatories were used.

Ergot. Twenty-four tablets had been taken during one week two years before entry, none since. No dinitrophenol had been ingested.

Radiant energy: X ray, radium, infra-red, and ultra-violet are excluded.

"Violet ray": The patient had been treated with "violet ray" two years before entry. Treatments were given because of two dislocated vertebrae following an automobile accident. The total period of treatment was almost one year with exposures at intervals of one to three times weekly. During exposures the patient was in the prone position, head turned to one side. Dark glasses were worn. Treatments were stopped one year before entry.

Vitamin deficiency: Except that the patient took no potatoes, mayonnaise, or sugar for several months before entry, her food was the average normal American diet. She ate an ordinary quantity of vegetables. No evidence of pellagra or other vitamin-deficiency diseases was seen on examination.

Kidney dysfunction. No evidence of such dysfunction could be obtained from the history, physical examination, or urinalysis.

Endocrine disturbances: Parathyroid. There was no history of tetany. Chvostek, Trousseau and tourniquet tests were negative.

Blood calcium .....10.3 mg. per 100 c.c.
Blood phosphorous .....3.9 mg. per 100 c.c.

Diabetes insipidus. No increase in intake or output of fluids.

Hypofunction of thyroid. No physical evidence. Basal metabolic rate, —15.6.

Dysfunction of anterior pituitary. No physical evidence present.

Diabetes mellitus. Blood sugar 121.2 mg. per 100 c.c. No sugar in the urine.

Congenital: The eyes were normal until the present illness.

Traumatic: No history of trauma was elicited, whether mechanical, electrical, light, heat, or chemical, except a fracture of the maxilla and nose more than two years before entry.

Secondary cataracts: No other ocular pathological condition was present.

## Summary

An account has been given of a woman, 23 years old, who took a reducing agent, "Slendrets," for a week and lost only two pounds in weight. This preparation contained no dinitrophenol, yet the woman developed cataracts similar in every way to those we have associated with the ingestion of this drug.

Thorough examination and history were negative except for the following data: A fractured nose, fracture of the right maxilla, and the use of ergot over two years before entry; use of quinine three months before entry; a fever of unknown etiology one year before entry; the extraction of five teeth because of apical abscesses two months before entry; and chronic pelvic inflammatory disease.

We do not believe that the above-mentioned positive findings were pathogenic factors in this case. The cause of the patient's cataracts remains unknown. They are certainly not coincident with the taking of dinitrophenol.

# AN ANALYSIS OF 71 CONSECUTIVE CASES OF UNILATERAL EXOPHTHALMOS*

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For the purpose of investigating the etiological factors producing unilateral exophthalmos, 71 such cases in the files of the Wilmer Ophthalmological Institute from 1925 to 1936 have been studied and analyzed. All cases originating on the other services of the Johns Hopkins Hospital have been excluded for the reasons that such cases on the otolaryngological, neurosurgical, or medical services would give a false impression of the incidence of orbital abscesses, orbital or brain tumor, or hyperthyroidism, and so forth, as the causative factors. The cases here analyzed represent a fair cross-section of unilateral exophthalmos as observed in an urban ophthalmological clinic. They may be classified as follows:

1. *Malignant tumors:* (a) primary orbital tumors, (b) metastatic orbital tumors, (c) tumors involving the orbit by extension.

2. *Benign tumors:* (a) primary orbital tumors, (b) noninflammatory conditions involving the orbit by extension, (c) mucoceles.

3. *Orbital inflammations.*

4. *Orbital traumatisms.*

5. *Unclassified exophthalmos.*

Operation was performed on 42 patients, the final diagnosis of the condition being confirmed by biopsy. A clinical diagnosis was made on the remaining 29 patients as a result of the clinical picture, the subsequent course after irradiation or anti-syphilitic therapy, or, as in the patients with metastatic orbital tumors, confirmed by the finding of a primary lesion elsewhere.

Each group has been studied with regard to the clinical picture and course, and the reactions to the several types of therapy. The great majority of these have been followed over a number of years.

## 1. MALIGNANT TUMORS

*(a) Primary orbital tumors.* There were 15 patients with the following primary orbital tumors: 10 sarcomata, two dural endotheliomata, one mixed tumor of the lacrimal gland, one adenocarcinoma of the lacrimal gland, and one neuroblastoma of the optic nerve.

The average age of patients in the entire group of primary orbital sarcomata was 31 years. These were, however, sharply divided into two age groups (table 1), children and adults. Four of the 10 cases were in children, the average age occurrence being five years, while six were in adults over 40 years of age, the average being 52 years. Sarcomata were not seen in patients between the ages of 12 and 40 years.

A striking difference existed in the clinical picture of these two age groups. In the children the development of the exophthalmos was acute and sudden, the average time between the first appearance of symptoms and examination being only six weeks. In the adult group the development of the exophthalmos was much slower, the average interval between the time when symptoms were first noticed and when the patient sought a physician being 22 weeks.

The outcome in the cases of sarcomata, both in children and adults, was equally poor. Three of the children were operated upon, two dying within a few months of generalized sarcomatosis. The third

*From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital.

child is still living with no clinical symptoms after five months. The fourth child was not operated upon, dying in less than one month. Five of the six adults have been followed. All of these were operated upon, four by orbital exenterations. In the fifth an encapsulated sarcoma was removed, apparently completely, by the Krönlein route. Three of the patients operated upon by orbital exenterations died from metastases within two years. The remaining two patients are still living after five months and two years, respectively.

TABLE 1

SARCOMATA

| Group I. | Age | Duration of Proptosis | Type of Operation | Type | Result |
|---|---|---|---|---|---|
| 1 | 2 yrs. | 5 wks. | Frontal approach | Lymphosarcoma | Metastases in one month |
| 2 | 12 yrs. | 9 wks. | Frontal approach | Spindle-cell sarcoma | No recurrence in five months |
| 3 | 3 yrs. | 10 wks. | None | ? | Died in less than one month |
| 4 | 3 yrs. | 2 wks. | Biopsy | Round-cell sarcoma | Died in less than one month |
| Group II. One case seen in consultation not followed. | | | | | |
| 5 | 58 yrs. | 7 wks. | Exenteration | Angiosarcoma | No recurrence in two years |
| 6 | 52 yrs. | 6 mos. | Krönlein | Angiosarcoma | Metastases within three months |
| 7 | 53 yrs. | 1 yr. | Exenteration | Melanosarcoma | Metastases within two years |
| 8 | 43 yrs. | 6 wks. | Exenteration | Round-cell sarcoma | Died within one year |
| 9 | 57 yrs. | 6 mos. | Exenteration | Type not stated | No recurrence in five months |

*(b) Metastatic orbital tumors.* Six patients had metastatic orbital tumors (table 2), of which three were from carcinoma of the breast, one from a sarcoma from the femur, one a multiple myeloma originating from the humerus, and one from a neuroblastoma of the adrenal. In two patients there was a history of malignant disease of the breast and femur, respectively; in the remaining four the primary lesion was discovered during routine examination while the patient was on the ward. In all there was clinical evidence of other metastases. The average duration of the exophthalmos was nine weeks, the longest being six months and the shortest, one week. Three patients died shortly after they were first seen, and the remaining three have disappeared from observation.

*(c) Tumors involving the orbit by extension.* There were 10 cases in which the orbit was involved by direct extension of malignant tumors. Five of these were basal-cell carcinomata originating from the lid in three patients, and from the inner canthus in two patients. Three of these patients received irradiation without appreciable benefit and are still under observation. In two patients the condition

was so advanced that immediate exenteration was performed, and these patients are still living. The other six cases were of extensions of the malignant tumor from the sinuses or nose. In four the diagnosis was confirmed by biopsy. Three tumors were primary in the antrum; two were sarcomata and one was a carcinoma. One tumor was a sarcoma of the ethmoids, and one a carcinoma arising from a nasal polyp. In none of these cases was either the primary or secondary growth removed. Of the four patients who were followed, all received courses of X ray or radium irradiation without improvement.

2. BENIGN TUMORS

*(a) Primary orbital tumors.* There were eight benign primary orbital tumors, five angiomata, one sebaceous cyst, one recurrent fibroma, and one recurrent lymphoma (table 3). Four of the patients with angiomata were operated upon, one by the Krönlein route, two by frontal approach, and one by exenteration. The average age of these patients was 32 years. In three of these patients the tumors were apparently removed completely, and at last reports all patients were living and well. In one case operation was abandoned on account of operative shock. The patient was later given irradiation with definite improvement. The remaining, fifth patient was given a diagnosis of congenital hemangioma, and was treated with irradiation, with no change in the clinical picture. The patient with orbital fibroma showed a recurrence four years later when a small nodule was removed; there have been no further symptoms. The sebaceous cyst was removed by the frontal approach; the lymphoma likewise by the frontal route, but it later recurred and is now being treated by irradiation.

*(b) Noninflammatory conditions involving the orbit by extension.* Four patients showed orbital involvement by extension of benign tumors from neighboring structures. One was a boy of 13 years with an extension of an intractable angioma from the right antrum. This had existed for four years before exophthalmos developed and had repeatedly resisted attempts at removal, irradiation, and ligation of both external carotids. At the end of a period of four years the condition was still unchanged. One patient had an ossified fibroma of the frontal region which was successfully removed by a left craniotomy. One patient had a pulsating exophthalmos which was improved, but not entirely cured, by ligation of the left internal-carotid artery. There was one encephalocele in a 21-month-old infant who died of postoperative complications.

TABLE 2

METASTATIC ORBITAL TUMORS

| Case | Age of Patient | Duration of Proptosis | Eye Involved | Primary Lesion | Primary Lesion Discovered |
|---|---|---|---|---|---|
| 1 | over 50 yrs. | 2 mos. | Left | Breast | 2 yrs. before |
| 2 | 60 yrs. | 1 mo. | Right | Breast | On ward |
| 3 | 60 yrs. | 2 mos. | Left | Breast | On ward |
| 4 | 47 yrs. | 3 mos. | Left | Femur | 3 yrs. before |
| 5 | 19 mos. | 1 wk. | Left | Adrenal | On ward |
| 6 | 56 yrs. | 4 mos. | Left | Humerus | On ward |

*(c) Mucocele.* There were five patients with extension to the orbit of mucoceles arising in the neighboring sinuses (table 4). In four, the correct clinical diagnosis was made preoperatively. Each showed an active sinusitis confirmed by X-ray examination. In the last patient, mucocele was considered as a possibility, but in view of the two-year history of blindness, passed from observation.

In four patients the inflammatory nature of the mass was not recognized, the clinical diagnosis being orbital tumors. These patients were operated upon and a mass of chronic inflammatory tissue removed. These instances of pseudotumors will be discussed later.

There were three cases of orbital cel-

TABLE 3

BENIGN PRIMARY ORBITAL TUMORS

| Case | Age yrs. | Duration of Proptosis | Type of Operation | Diagnosis | Subsequent Course |
|---|---|---|---|---|---|
| 1 | 29 | 5 yrs. | Frontal approach | Fibroma | Small recurrent nodule removed 4 years later |
| 2 | 2 | 1½ yrs. | Frontal approach | Sebaceous cyst | No recurrence in 4 years |
| 3 | 50 | 5 yrs. | Krönlein | Cavernous Hemangioma | No recurrence in 4 years |
| 4 | 16 | 5 yrs. | Frontal approach | Angioma | Received irradiations with improvement |
| 5 | 31 | 2½ yrs. | Frontal approach | Fibroangioma | No recurrence |
| 6 | 71 | 8 yrs. | Exenteration | Cavernous Hemangioma | No recurrence in 4 years |
| 7 | 40 | 1 yr. | Frontal approach | Lymphoma | Recurrence 4 years later; given irradiation |
| 8 | 21 | 21 yrs. | None | Congenital Hemangioma | Irradiated; no change in clinical picture |

together with optic atrophy of the involved eye, an extensive retrobulbar tumor was thought to be the more likely cause.

All of these five patients were operated upon, four successfully with no recurrence. The last patient showed a recurrence three years later.

### 3. ORBITAL INFLAMMATIONS

Of the 10 patients in this group (table 5), four were given a diagnosis of gummata of the orbit. In each there was a positive blood Wassermann reaction, and three of these patients were treated in this clinic, showing improvement under antisyphilitic therapy. The fourth patient lulitis secondary to sinus infection. All of these were in children. In one patient the infection was primary in the antrum and healed spontaneously under local treatment without operation. In the other two patients the primary source of infection was in the posterior ethmoids. Both of these patients were operated upon, the abscess being allowed to localize. Recovery was uneventful in both instances.

### 4. ORBITAL TRAUMATISMS

There were three cases of unilateral proptosis due to retrobulbar hemorrhage. In each instance the cause was a direct blow in the region of the globe, and in all the proptosis occurred within several

hours after injury. One case could not be followed. In the other two the proptosis receded in 13 and 22 days, respectively, without special treatment.

### 5. Unclassified proptosis

There were nine patients who were not included under the previous classification. In six of these patients the clinical diagnosis was primary orbital tumor. These patients all refused operation and have disappeared from observation. One similar case of 18-months' duration was treated by irradiation and after three years the clinical picture is unchanged. One patient showed in addition to the proptosis, erosion of the posterior clinoid process. It was thought that an infiltrating growth from the pituitary was the most likely diagnosis. The patient was treated by irradiation, but the condition has been slowly progressing.

The last patient in this group is of some interest. A man of 40 years, he had had a proptosis of 6 mm. all his life. No cause could be found other than a myopia of 20 diopters. This degree of myopia indicates an increase of 6 mm. in the antero-posterior diameter of the eye and would account for the proptosis, provided increase in the axial meridian were reflected entirely in the forward displacement of the eye.

## Discussion

The most interesting malignant tumors were the lacrimal-gland tumors, the sarcomata, and the dural endotheliomata. Lane[1] reported 95 cases of lacrimal-gland tumors from the literature, with 12.6-percent mortality, 20-percent recurrences, and 6.4-percent distant metastases. These tumors are readily accessible and therefore favorable for complete removal, but if not entirely removed at the first operation, become progressively malignant. In the two such patients in this series, there has been no recurrence in one year.

TABLE 4

Mucoceles

| Case | Age | Duration of Proptosis | X-ray Findings | Extension from |
|---|---|---|---|---|
| 1 | 45 yrs. | 4 mos. | Clouding of right antrum | Right antrum |
| 2 | 65 yrs. | 1 yr. | Pansinusitis with mucocele right frontal | Right frontal |
| 3 | 42 yrs. | 1 yr. | Clouding of left frontal. Ethmoids are broken down, may be due to tumor destruction | Left frontal |
| 4 | 43 yrs. | 4 yrs. | Bone destruction in orbit. Clouding of left antrum | Left antrum |
| 5 | 53 yrs. | 1 yr. | Clouding of antra and ethmoids. Erosion of supra-orbital ridge | Ethmoids |

Sarcomata are generally believed to be the most common of all primary orbital tumors. The incidence in this analysis confirms this view. They are usually thought to be more common in the first decade of life. The cases here reported fall into two distinct age groups: in children with an average age of five years, and in adults over 40 years of age. While no conclusion can be drawn from a small series, this study indicates the most frequent cause of unilateral exophthalmos in children to be sarcoma. A rapid exophthalmos in the absence of inflammatory symptoms is strong persumptive evidence for this diagnosis. An analysis of 14 cases by Reese[2] showed that in the twelve cases which could be traced the patients lived only for an average of one year after the

manifestation of the new growth. These cases show that of the nine patients who could be followed, six died within two years and three are living from five months to two years after the removal of the growth. The mortality was slightly greater and more rapid in the younger group. This is in accord with the usual belief that the younger the patient, the more malignant the tumor. The various tumor cells or emboli more readily pass the narrow opening of the ophthalmic artery, thus being carried to the brain or meninges. In five of these six patients, the metastasis occurred in the left eye. This may also be explained on an anatomical basis, since the left eye is along the most direct route of the blood channels, the left common carotid branching directly from the arch of the aorta, while the right internal carotid leaves the innominate at an obtuse angle.

TABLE 5

ORBITAL INFLAMMATIONS

| Case | Age | Sex | Pain | Duration of Proptosis | Blood Wassermann | Result after Antisyphilitic therapy |
|---|---|---|---|---|---|---|
| **GUMMA** | | | | | | |
| 1 | 40 yrs. | F | yes | 4 mos. | 4+ | Improved |
| 2 | 38 yrs. | F | yes | 4 mos. | 4+ | Improved |
| 3 | 40 yrs. | F | yes | 5 mos. | 4+ | Improved |
| 4 | 39 yrs. | M | yes | 1 mo. | 4+ | Not followed |
| **PSEUDOTUMOR** | | | | | | **Result after Operation** |
| 1 | 9 yrs. | F | yes | 4 mos. | Neg. | Proptosis still present 1 yr. later |
| 2 | 29 yrs. | M | no | 6 mos. | Neg. | No recurrence |
| 3 | 28 yrs. | F | yes | 1 mo. | Neg. | No recurrence |
| 4 | 43 yrs. | M | yes | 2 wks. | Neg. | No recurrence |

pathological types encountered revealed no pertinent facts as to age of occurrence, reaction to therapy, or prognosis.

It is believed that by far the greater majority of dural endotheliomata of the orbit are extensions of an intracranial growth. In the two cases here reported, however, the visual loss extended over a period of 20 years in one, and over one year in the second. The length of duration of symptoms in the first case would argue against a primary intracranial growth.

Metastatic orbital tumors are a clinical rarity. This is possibly influenced by the fact that the ophthalmic artery leaves the internal carotid at a right angle, and the

The patient with neuroblastoma of the adrenal was a child of 19 months. The exophthalmos was the most rapid—one week. In 17 cases of adrenal tumors of this type, recently reported by Askins and Geschickter,[3] three showed orbital involvement.

Multiple myeloma is a distinct clinical rarity. The patient in this series was a woman of 56 years, who showed, in addition to 12 mm. of proptosis, areas of destruction in the skull and bones of the arms. Diagnosis was made from biopsy. The Bence-Jones proteinuria usually found in these cases was negative.

The basal-cell carcinomata were all extensions from the usual sites—the lids and inner canthi. These tumors were of slow growth and produced the characteristic inflammatory reaction. One of the great dangers of these surface tumors of the lids and canthi is their tendency to invade the underlying, more areolar tissues, thus becoming retrobulbar.[4]

Benign primary orbital tumors are characterized by their slow growth and absence of inflammatory symptoms. Angioma was the most frequent type in this series and was so regarded in the literature. The average duration of the exophthalmos in these patients was six years. Such tumors are generally believed to be congenital in origin, but curiously enough become manifest any time in the first three decades of life. They are slow growing and tend to encroach upon the vital contents of the orbit. Because of this they must be considered dangerous.

Mucoceles present little difficulty in diagnosis and lie within the province of the otolaryngologist. They should always be attacked from the infected sinus and not from the orbit. Encephaloceles likewise belong in the field of neurosurgery. The one patient having a pulsating exophthalmos whose case is here reported was operated upon by the older method of ligation of the internal carotid, before the introduction of the later method of intracranial ligation.

The inflammatory conditions are of some interest. The four gummata all occurred in the colored race. The average age of this group was 39 years, and the average duration of the proptosis was 3½ months. Pain was a constant feature in all. In one patient the diagnosis was confirmed by biopsy. After antisyphilitic treatment was started, three of the four patients showed definite decrease in the amount of proptosis.

Four cases must be classified as "pseudotumors." With the exception of negative Wassermann reactions, including provocative tests in two, the clinical picture was strikingly similar to the four cases of gummata. The etiology of these tumors is indefinite. They are clinically impossible to differentiate from real tumors. The patient usually complains of a painful protrusion of one eye over a period of several months. Often a tender mass is palpable along the orbital rim. Exhaustive clinical and laboratory examinations are negative. At operation a mass is easily removed and the pathological diagnosis of "chronic inflammatory tissue" gives no inkling as to the etiological factor. There is no clinical or histological evidence that the lesion is tuberculous. Friedenwald[5] believes that in spite of the negative Wassermann reaction, such cases are probably gummata. Of some interest is the fact that of 30 cases analyzed by Reese,[2] exenterations of the orbit had been performed in 15, or 50 percent, for supposed tumors which proved by histological examination to be chronic inflammatory tissue instead. Since the greater number of orbital tumors are not painful, this peculiar inflammatory pseudotumor must definitely be ruled out when dealing with a painful proptosis.

The essential point in the operative treatment of orbital abscesses secondary to infections of the adjacent accessory nasal sinuses is that drainage of the orbit must be postponed until the abscess has become definitely localized. The early exploration of orbital abscesses, before such localization has occurred, has too often resulted in dissemination of the infection in the orbit with resulting meningitis and death. If the sinuses have been properly drained, there is little danger in postponing drainage of the orbit, and much to be gained in more speedy recovery.

In this discussion no mention has been made of the removal of orbital tumors by

the transfrontal intracranial approach. This method of approach, however, is the method of choice in all tumors lying deep in the orbit and not palpable beneath the orbital margins. Deep-lying orbital tumors may be orbital extensions of intracranial neoplasms, entering the orbit through the optic foramen or sphenoidal fissure. In such cases the intracranial approach usually permits removal of the entire tumor. For this reason, during the past year, it has become routine to transfer this class of patient to the department of neurosurgery for this type of operative interference.

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# THE TREATMENT OF OCULAR SYPHILIS*

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The treatment of ocular syphilis is the treatment of general syphilis plus measures to take care of the local complications. For this reason, a complete physical examination of the patient is necessary in order to rule out complicating diseases such as tuberculosis, nephritis, diabetes, hypertension, and atherosclerosis. The desired end result of all treatment is cure. But cure in syphilis is susceptible of three interpretations[1] as follows:

1. A biologic cure—the complete eradication of all treponemata.

2. A symptomatic cure—meaning that all signs and symptoms disappear, and the disease cannot be transmitted.

3. A serologic cure—in which the spinal fluid and blood are negative to the complement-fixation tests.

The first two are the desired results, the third, a serologic cure, can accompany both a clinical and pathological progression of the disease. Seemingly, this may be true indefinitely. The writer, at present, is treating a man, aged 57 years, who came to the Brooklyn Eye and Ear Hospital because of blurring and pain in the left eye of two weeks' duration. At 19 years of age, he had had an infection of his penis, of whose nature he was not sure and for which he received no treatment. He had been married for 20 years and there were no children nor miscarriages. His wife had died a few years ago, the cause unknown. Examination showed an unquestionable interstitial keratitis. A Wassermann test was negative. On two previous occasions the Wassermann tests had been made because he had pains in the upper abdomen, and were negative. For a long time he had been having shooting pains down his legs. There were no signs of tabes. Since receiving antiluetic treatment, these pains as well as the abdominal pains have practically disappeared.

The drugs used in syphilis are arsenic, bismuth, mercury, and the iodides. Of

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these, by far the most important are the arsenicals; because they are the only drugs that are actively treponemacidal, killing the parasites with which they come in contact.

Except tryparsamide, which will be discussed later, the arsenicals are contraindicated if the kidneys are impaired, in debility, and in advanced cardiovascular disease. Arsenicals must also be used with great caution in cases of late syphilis because their intense action produces a rapidity of healing which may have disadvantages—a therapeutic paradox. In late syphilis, rapid healing means fibrosis, which may lead to serious consequences. Stokes[2] quotes deSchweinitz as having repeatedly emphasized the damage done by fibrotic healing of late ocular syphilis by a too energetic course of arsphenamines.

The arsphenamines may also cause ocular reactions which are classified in three groups, as follows:

1. A true toxic reaction, as shown by a conjunctival hyperemia, chorioretinitis, corneal necrosis, and an exfoliative keratitis associated with an exfoliative dermatitis. This latter, very serious complication may be avoided by stopping the injection immediately if the patient begins to complain of a warm and itching skin. To avoid this happening, the possible existence of allergy, eczema, or any other skin condition should be investigated.

2. Ocular therapeutic shock—the Jarisch-Herxheimer reaction, which may appear as (a) an intensification of an existing lesion, (b) a flare-up of a quiescent lesion, or (c) as the unexpected appearance of an inflammatory process apparently not affected previously.

The Herxheimer reaction is very serious in optic neuritis and optic atrophy because sudden and permanent blindness may result. To avoid this a patch test for the sensitivity to arsenic may be made, and if positive, or in cases in which for other reasons the possibility is feared because of a history of allergy either in the patient or in the patient's immediate family, a long preparatory course of treatment with the heavy metals should be given. As Stokes[3] points out, therapeutic-shock effects are produced primarily by premature use of the arsphenamines and by overdosage with them.

3. The third type of reaction is the neuritic or iridic recurrence following insufficient treatment in early syphilis—the "récidive" reaction.

Obviously, the most important time for treatment is in the early phase of syphilis. The Spirillum is essentially a tissue parasite, and its stay in the circulation is brief. Because of this rapid dissemination of the spirochete, excision or cauterization of the chancre, no matter how early is fruitless.

In early syphilis, arsphenamine is vastly superior to neoarsphenamine. It should not be given in small and gradually increasing doses because of the danger of producing a drug-fast organism.

At first the combined treatment of arsenic and a heavy metal is advantageous, but after three or four weeks they should be given alternately. The proper treatment of syphilis in any stage is continuous and not by intermittent courses, and should be continued for one year after negative spinal and blood-Wassermann tests are obtained and have remained negative. The spinal fluid should always be tested in early syphilis, and if negative, the test should be repeated in a year.

Incomplete treatment is extremely dangerous in early syphilis because not only does the germ become resistant to further treatment but, as will be shown later, the natural immunity of the host is destroyed. There is also the danger of the "récidive" reaction. Neuro and ocular

complications develop in a larger percentage of these cases than in those in which no treatment was administered at all. In late syphilis, immunity is well established and insufficient treatment at that period merely stimulates further progression of the disease.

The danger of insufficient treatment is shown by the following table based on a large number of cases treated at Johns Hopkins University, which indicates the probable outcome of syphilis untreated, poorly treated, and well treated.[4]

| Types of Syphilis | | Probable Outcome, Expressed in Approximate Percent, if | | |
|---|---|---|---|---|
| Original Diag. | Ultimate outcome | Untreated | Inadequately Treated | Throughly Treated |
| Early Syphilis | Serious late Syph. | 25 | 35–40 | 5–10 |
| | Benign late Syph. | 15 | 15 | 5 |
| | Latent Syph. | 30 | 30 | 5 |
| | "Cure" | 30 | 15–20 | 80–85 |

Neoarsphenamine is variable in its action and as bought in the open market is frequently worthless. It should never be allowed to stand open to the air, for it rapidly becomes toxic when exposed to oxygen, especially when agitated too violently during the mixing. However, it is less toxic than arsphenamine and can be given with greater impunity in cases of debility and late syphilis. Moreover it is easier to administer.

Tryparsamide is a pentavalent arsenical which contains about 25-percent arsenic: It is much less toxic than any other arsenical and the danger of a Herxheimer reaction is much less. It has an especial affinity for the nervous system, not possessed by the trivalent arsenicals (arsphenamine or neoarsphenamine), and so is valuable in the treatment of cerebral lues. It is also valuable in cardiovascular lues when combined with cerebral lues.

Moore,[5] basing his opinion on the work of Alan Woods, believes that tryparsamide should not be used in the presence of optic atrophy. According to him, 15.7 percent of 241 patients treated with tryparsamide had ocular symptoms, such as a dazzling sensation in which everything appeared wavy, and the development of a gradual but permanent contraction of the visual field. He believes that simply testing for the visual acuity is not sufficient in the case of patients receiving tryparsamide. Other authors do not consider the drug so dangerous. In a series of cases being followed up by the writer on Dr. C. Hargitt's service at the Brooklyn Hospital for the past four years, no patient developed any serious complication. One, a colored woman who had a slight optic atrophy in both eyes, developed a blurring of vision after seven injections of tryparsamide with cisternal drainage. She was examined during the complaint and only a slight contraction of the peripheral field was found. Tryparsamide therapy was stopped. She was referred back again on December 17, 1936, because the genito-urinary department wanted to start tryparsamide therapy again. The last previous injection was given in 1934. Examination showed no progression of the optic atrophy, there had been no further contraction of the fields, and vision was 13/15 O.D. and 13/13 O.S. Since then this patient has received several tryparsamide injections without experiencing any symptoms or

further contraction of the fields. From our observations at the Brooklyn Hospital, we must conclude that tryparsamide is not contraindicated in cases of optic atrophy; in fact, in several such cases there seems to have been some improvement. However, until further study, it might be wise to be cautious in its use. It should be given frequently over a long period of time—at least 70 to 100 injections are necessary.[6]

Of the newer arsenicals, mapharsen seems to be destined to attain a permanent place among antisyphilitic drugs. According to Astrachan,[7] it is less toxic than neoarsphenamine and is especially important in early cases in which drastic therapy is contraindicated. Latent syphilis seems to be its proper field of use. It should be given concurrently with bismuth and not alternately.

In the modern treatment of syphilis, bismuth has almost entirely replaced mercury, for it is much less toxic and has more effect on the Spirillum. Bismuth is weakly treponemicidal. Its main action is treponemistatic, meaning that it interferes with the development and multiplication of the organisms. Because of this action, it is desirable to maintain a low concentration of the bismuth in the tissue over a prolonged period of time. For this reason, the insoluble forms, especially the salicylates, should be used. Bismuth is effective in cases of osseous syphilis and so is to be used for periostitis of the orbital bones. Its toxicity is very low, hence it is useful in complicating cases of renal or liver disease in which arsenic and mercury are contraindicated.

Stokes[8] believes that bismuth sulpharsphenamine has been somewhat overlooked. It has given him excellent results in cardiovascular lues.

Bismuth should never be used alone in the treatment of syphilis except when arsenic is contraindicated.

Mercury is now seldom used. Stokes,[9] however, believes that it still is of value in cases of neurosyphilis, when used as massive inunctions, tryparsamide also being administered at the same time.

The iodides have been used for hundreds of years, not because of their curative powers, but because in cases of late syphilis, they heal gummatous lesions and relieve pain. They probably help in the destruction of the treponemata by enhancing the penetrative powers of other drugs.

Congenital syphilis usually occurs as an interstitial keratitis in children. An important rule to remember in the treatment of children is that they are more tolerant of arsenic than adults and so should be given relatively larger doses. If relief from interstitial keratitis is not obtained in from 10 to 16 weeks, treatment should be switched to bismuth and the iodides. Moore[10] believes that in cases of early congenital syphilis, the drug of choice is sulpharsphenamine.

Weak roentgen rays[11] have been tried in Germany, and good results in cases of interstitial keratitis have been reported. For the past several years, at the Brooklyn Eye and Ear Hospital, Dr. M. L. Lines has been treating various corneal diseases, acute and chronic, with diathermy and the short wave. To date she has demonstrated several cases of interstitial keratitis, acute and chronic, that have shown startlingly rapid improvement. It is hoped that Dr. Lines will soon have sufficient material to publish her results. Its use certainly seems to be rational and worthy of trial.

If one has to operate on a patient with syphilis, treatment should precede and follow the operation. If it is an emergency operation, it should be followed by antiluetic treatment. In patients with senile cataracts, syphilis, if present, is usually latent, and treatment should be mild. Fol-

lowing operation, mixed treatment by mouth should be given, to be followed later by small doses of arsphenamine.

In any case, if after operation the wound does not heal so quickly as one would expect, syphilis should be suspected. This is well exemplified by a recent case in which a purulent tear sac was removed from a woman aged 55 years, who had four healthy grown children and several grandchildren. After removal of the sac, the wound would not heal in spite of the administration of antiseptics, vaccines, and phages. Just about the time when the patience of both the doctor and patient was exhausted, the family doctor, who had referred the patient, asked if the fact that he had once treated the patient for syphilis and that she still had a 4-plus Wassermann reaction made any difference. In two weeks after she was placed on antiluetic treatment the wound had entirely healed.

The optic atrophies, which are a part of neurosyphilis except when they follow an optic neuritis, should be treated by subdural injections of arsphenamine. Fever therapy, especially when optic atrophy is in association with a paresis, is very valuable. Heinsius[12] believes that malarial therapy, if given before degenerative lesions of the nerve have gone too far, will arrest the disease. However, not all reports have been so optimistic and many cases of optic atrophy progress steadily in spite of strenuous hyperthermic treatments of one kind or another. Recently, at the Brooklyn Hospital, a woman with cerebral syphilis with normal vision was treated by fever therapy. She thereafter became completely blind for several weeks. A few months later she had regained somewhat less than 50 percent of her vision. More research along these lines should be done in our public institutions where large numbers of such cases are available. The results of optic atrophy are so tragic that no treatment can be too strenuous, provided the end warrants the means.

Recently, Professor Lauber[13] advocated measures to increase the general blood pressure or to reduce the intraocular pressure in order to bring back the normal relationship which he claims has been disturbed and which he thinks is a cause of optic atrophy. He believes that treatment with arsenicals during such a period of disturbed relationship rapidly increases the destruction of the optic nerve.

The nature of immunity in syphilis is not known. That such an immunity is present, Horgan[14] believes is proved by spontaneous cure in some cases of undoubted syphilis, and also by the cure in other cases in which inadequate treatment was given, as well as by the fact that, while some patients are cured by treatment, others get no result even after the most massive doses. As in other diseases, some individuals have greater protective power than others. It is known that alcoholics and tuberculous patients have more severe syphilis. Immunity in syphilis is a local tissue reaction which forms only a weak general defensive mechanism. A chancre, while it does not prevent the spread of the disease, inhibits it. If a chancre experimentally is excised, there is a rapid dissemination of the disease. Evidence favors the belief that multiple reactions in the skin, extensive secondary eruptions, have a favorable influence on the course of the disease; they also give a good prognosis against the appearance of tabes or paresis in the future.

The latent periods in syphilis are the result of a relative immunity formed by slow chronic inflammatory changes in the paranchymatous structures and in the vascular system. While clinically the patients appear well, serious damage is being done all over the body. If in these

stages, inadequate treatment is given, virulent relapses occur. The reason is that antiluetic treatment lessens the immunity reactions of the body. If insufficient treatment is given, the germs are not killed off, and then with the immunity partially or wholly suppressed, there is a rapid and virulent lighting up of the disease, especially when treatment is again started, the so-called récedive reaction.

The production of an active or passive immunity against syphilis has universally failed. The production of a crossed immunity, such as infecting a syphilitic with a similarly related disease (yaws, rat-bite or relapsing fever) has been unsuccessful.

In conclusion one would emphasize the statement made by Stokes[15] in his book on the treatment of syphilis, "No variety of drugs or methods used late, can take the place of a powerful arsphenamine at the outset."

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# MUSCLE WEAKENING BY CENTRAL TENOTOMY*

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Surgical treatment has frequently been used for the various forms of heterophoria, muscular paralyses, and muscular imbalance. Different methods of approach have been employed; that is, advancements and tucking of the weak or paralyzed muscles, recession of the overactive member of the antagonistic pairs, tendon transplantation to aid the weaker muscle, the O'Connor cinch shortener, and, finally, complete and partial tenotomy, in its various forms, of the overactive muscle.

In central tenotomy of the overactive member of a pair, there is some doubt as to the net effect produced by the operation. Some surgeons employ this method to weaken a muscle, from analogy with the effect produced in an elastic substance, such as a rubber band, when partially cut through. Under a given tension, decreasing the cross-sectional area results in an increased stretch. Others, however, believe the muscle is weakened through adhesions to the posterior sclera, thereby reducing the mechanical advantage and degree of shortening that the muscle can undergo. The purpose of this investigation was to try to show which method is responsible for the end result.

## Experimental method

Decerebrate cats were used in our experiments. Under ether anesthesia, the skull was trephined and the brain-stem sectioned between the anterior and posterior corpora quadrigemina. Thereafter the animal was kept warm, and rigid physiological procedures were followed.

The marked similarities in appearance between the extraocular muscles and the semitendinosus muscle of the hind leg made the latter suitable for the investigation. It possesses a long thin membranous tendon of insertion, very similar to the tendons of the ocular muscles, and has a muscle belly similar in shape and relative size to that of the extraocular muscles. The advantage in using this muscle is that its tendon is some 4 mm. wide at its insertion, and the tension developed during its contraction can be conveniently measured.

The tendon of the semitendinosus was isolated on the medial aspect of the knee, and separated from the fascia surrounding it. Subsequently the femoral nerve was cut in the groin, the sciatic divided high in the thigh, and then the hamstring branch of the sciatic, supplying the semitendinosus, was isolated and cut. Accompanying this branch, there are frequently fibers which run to the biceps femoris, itself a knee flexor; these were cut when found. Drill pins were fastened to the greater trochanter and lateral condyle of the femur; the thigh was supported rigidly in a vertical position by upright clamps fastened to the table top. Sherrington electrodes were attached to the peripheral end of the cut motor nerve to the semitendinosus and, during the experiment, stimulated by maximal tetanizing shocks from a Harvard inductorium. A strong cord was sewn through the web of the foot and then tied to a horizontal recording lever suspended above it, whose motion was opposed by a fairly strong spring. Records were made of the isolated contraction of the semitendinosus before and after tenotomy.

The manner of stimulation was stand-

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ardized as carefully as possible. Records of contractions were obtained in groups of three, each contraction lasting two seconds, with a 15-second rest in between; and between groups, a longer rest of one minute, during which attention could be given to the preparation, tenotomies performed, and so on. The first group of records consisted of normal contractions, then the tendon was cut centrally by means of razor blades ground to the correct width, beginning with a one-millimeter cut, and enlarging this by millimeter intervals until the tendon was severed. Finally, the muscle was freed as far as possible from surrounding fascia or even partially excised, and the nerve stimulated to show the effect of the possibly remaining knee flexors. Usually this amounted to only a small fraction of the total tension developed. The records were calibrated by suspending known weights from the lever. The maximum and minimum contractions of any group rarely varied by more than 5 to 10 percent of the total.

Inasmuch as fatigue under maximal stimulation plays an important part, a series of fatigue determinations was made, employing groups of stimuli with their respective intervals, but without cutting the tendon. Later the fatigue rate was compared with the effects produced by tenotomy. The results were plotted as percentages of the initial maximum tension developed and are shown in the accompanying curves for three typical muscles.

## Results and discussion

The first part of each curve represents the rate of fatigue, determined as mentioned above. The muscle fatigues fairly rapidly because it is rather small and because the contractions are maximum. The latter half of each curve shows the effect of partial and complete tenotomy. Segment "0" represents the normal state just prior to tenotomy, and is a continuation of the fatigue experiment. Part 1 depicts the tension developed after a one-millimeter cut; part 2, the effect of a two-millimeter cut, and so forth. Following the incomplete tenotomy, the tendon was completely severed as described above, and the curve continued at a lower level. The lower level thus obtained after the final cut is the tension transmitted through the fascia from other flexors whose nerves have not been cut. It presumably follows the same

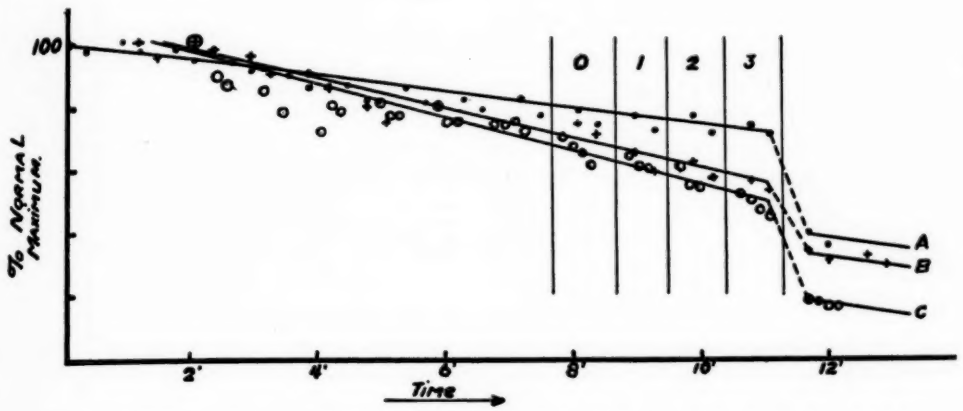


Fig. 1 (Watrous and Olmsted). Curves demonstrating the result of stimulating the M. semitendinosus of the cat's hind leg, both before and after tenotomy.

rate of fatigue as the upper part of the curve since the slope is naturally the same as before tenotomy.

It may be seen from the graphs that the fatigue and tenotomy effects may be represented on the same straight line, showing that central tenotomy is without effect in weakening the pull of the muscle. This is not entirely unexpected, for it is well known that there is a large factor of safety in tendons and that they are not truly elastic. Furthermore, the direction of pull of the muscle would be exerted chiefly upon the margins of the tendon, since they would be more directly in line with the muscular fascia covering. With even a small part of the tendon remaining at the margins, there is only the slightest decrease in tension, and this appears to be due to fatigue, since the curve is a continuous straight line.

It is to be noted that in these experiments we have used artificial maximum stimuli. The normal contraction of any muscle is never maximal; therefore, in the normal movements of the ocular muscles, there would be even less chance of a significant weakening through partial central tenotomy.

The other possibility, namely, adhesion to the sclera by the cut portion of the tendon and thereby reduction in the mechanical advantage, seems the more probable explanation of the effects of central tenotomy.

## Summary

Evidence has been presented which shows that if anything is accomplished by central tenotomy the beneficial results are due not to weakening of the hypertonic muscle through its tendon, but simply to a decrease in the mechanical advantage of the muscle acting on the eyeball through the formation of a new insertion, the result of adhesions.

# NOTES, CASES, INSTRUMENTS

## COLON-BACILLUS INFECTION OF THE CONJUNCTIVA*

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In all studies of the bacterial flora of the conjunctiva, colon bacillus is found in a small percentage of cases. While it is not regarded as pathogenic for the human conjunctiva, it may, under certain conditions, become quite virulent, Randolph[1] reports a number of cases of colon-bacillus catarrhal conjunctivitis and he also recovered a pure culture of this organism from the vitreous in a case of panophthalmitis. Collins and Mayou[2] give colon bacillus as a cause of conjunctivitis in children, but have seen only one case in adults. Axenfeld[3] found pure culture of colon bacillus in a series of cases of catarrhal conjunctivitis in newborn children. He states that there is no definite record of inoculation of the eyes of human beings with this organism, but that it has the power of producing inflammations and suppuration and is very pathogenic to test animals. Cooper,[4] in a study of 92 preoperative patients, found organisms in 86, three of which were colon bacillus. In his opinion, this was a chance contamination that was removed by the preoperative preparation.

The case herein reported is the first colon-bacillus infection of the conjunctiva that the essayist has seen, and he was completely at sea as to treatment. None of the textbooks, encyclopedias, or literature at hand gave anything on treatment. It was only after seven weeks that the correct effective remedy was accidentally used.

*Case report.* The patient, a male aged 80 years, was seen on December 12, 1934, in regard to the removal of a cataract. He had never had a severe illness and was well nourished and vigorous for his age. Blood and urine were normal; blood pressure 160/100. The vision of the left eye had been failing for about 10 years and more recently the sight of the right eye had decreased rapidly. Examination showed a mature cataract in the left eye with good perception and projection of light. Lid margins, conjunctiva, and the lacrimal sac appeared to be normal. The vision of the right eye was 1/10, but he obtained 5/10— vision with a correction. There were numerous riders in the lens of the right eye; more pronounced in the lower half and upper nasal quadrant. Operation upon the left eye was advised.

The patient returned on January 14, 1935, at which time he had a spasmodic, nonproductive cough, albumin in the urine, and a white-blood-cell count of 11,000. He was under medical treatment and I did not see him again until January 23d, when, on everting the lids and compressing the tear sac, there was a slight bluish-pink flush of the conjunctiva of the left eye. This was in marked contrast to the condition in the right eye, which had been subjected to the same manipulation. A smear taken at this time showed a gram-positive diplococcus. A weak solution of zinc sulphate was prescribed. On January 27th, the diplococci were still present in the smears. On January 31st, the report on the culture was: "no growth in the right eye and a colon bacillus in the left." On February 5th, the culture was positive in the left eye and a 2-percent solution of merthiolate, three drops every three hours, was given. On February 11th, the culture was posi-

* Read before the Pacific Coast Oto-Ophthalmological Society, at Salt Lake City, May 26, 1937.

tive and a 10-percent solution of sodium carbonate, three drops every four hours, was prescribed. This seemed to modify the character and reactions of the organism. A culture was sent to the laboratory of the University of Oregon Medical School for identification and was confirmed as colon bacillus.

On March 7th, the culture was still positive. After seven weeks of unsuccessful treatment, I filled the conjunctival sac with 1-percent Ungt. Hydrar. Ox. Flav., for no specific reason, applied a sterile gauze patch and asked the patient to return the next morning. A culture taken then showed no growth after 48 hours, nor was a positive growth again obtained from that eye.

On April 1st, the patient's general condition had improved and he was referred for operation. A culture was made from both eyes, and the right, which had always been negative, showed a positive growth for colon bacillus. An irrigation of 1 :8000 solution of oxycyanide of mercury was used three times a day, and the culture was negative on April 11th. Five days later, after preoperative irrigation of the conjunctival sac with 1 :10,000 bichloride solution followed by a normal saline solution, an extracapsular extraction of the left lens was made without incident. The convalescence was smooth except that the conjunctiva remained red for a longer time than usual, probably due to the use of 1 :10,000 oxycyanide of mercury, one drop night and morning, after the eighth day. Glasses were prescribed on May 28th, and with these vision was 6/10—. The patient read J 3 quite readily and J 2 slowly.

On November 12, 1935, he came to Portland to visit his sons and went to bed that night in fine spirits. The next morning he was unconscious. He was brought to the hospital and found to have a complete paralysis of the left side of the body and the right side of the face. On ophthalmoscopic examination, the media were clear and no fundus changes were found in the left eye. In the right eye, the cataract obscured a good view of the fundus. Cultures from both eyes were negative for colon bacillus. The patient never recovered consciousness and died on December 4, 1935.

In searching for the source of infection, swab cultures of the nose were made several times and once, after cleansing the nose carefully, the lacrimal sac was irrigated and the solution recovered from the nose, sedimented and cultured. All such tests were negative. The urine on several occasions contained colon bacillus and personal contamination from this source was the most probable cause.

In the Journal of the American Medical Association is a letter that I wish might have been written several weeks previously. In it, Justina H. Hill[5] compliments Crance[6] on his recognition of the necessity of differentiating colon-group bacilli into their two genera. This is important because the Aerobacter group is much more resistant to drugs than the Escherichia: "For example, mercuric chloride in broth inhibits the growth of Escherichia in a dilution of 1 :500,000 but a 1 :30,000 is required to inhibit the growth of the Aerobacter."

With fresh broth cultures of colon bacilli obtained from two laboratories, I inoculated the eyes of three rabbits by placing two drops of the culture in the conjunctival sac of each eye. The right eyes were then rather vigorously massaged. No massage was used on the left eyes. Cultures taken on the third days showed no growth from the left eyes and a good growth from all of the right eyes. Other cultures, taken on the fifth and seventh days, were positive for the right

eyes and negative for the left. On the eight day after the cultures were made, treatment was given as follows:

Rabbit 1. Conjunctival sac filled with 1-percent Ungt. Hydrar. Ox. Flav.

Rabbit 2. Eye irrigated with 1:2000 solution of metaphen.

Rabbit 3. Eye irrigated with 1:8000 solution of oxycyanide of mercury, once for three minutes.

Cultures taken on the ninth day showed no growth at the end of 24- and 48-hour periods. This would seem to indicate that some form of traumatism is necessary to enable the colon bacillus to infect the conjunctiva and confirms former reports of this organism's susceptibility to preparations of mercury.

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# SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

## WASHINGTON, D.C., OPHTHALMOLOGICAL SOCIETY

March 1, 1937

Dr. James N. Greear, Jr., *president*

### Visual fields, pupils, and other ocular signs associated with tumors of the lateral geniculate body and superior colliculus

Dr. James W. Watts said that Alpers and Watts (Arch. Neurol. and Psychiat., 1935, v. 34, pp. 1250-1273) made a clinical and pathological analysis of mesencephalic glioma. Within the past year two additional cases had come under his observation. Of the 11 cases verified by autopsy, the lateral geniculate body was invaded by tumor in five and the superior colliculi in all 11.

Without the aid of ophthalmology and roentgenology, the early diagnosis of brain tumor is almost impossible except when the tumor involves the motor or sensory pathways. Even with the aid of the ventriculogram, gliomas in the region of the superior colliculi and lateral geniculate bodies, Dr. Watts said, are difficult to differentiate from celebellar tumor. Alpers and Watts found that when the tegmentum and basis of the mesencephalon was invited by tumor, the diagnosis was not difficult. One finds a combination of cranial nerve, cerebellar, pyramidal tract, and sensory signs. When the tumor is largely confined to the tectum, signs of increased intracranial pressure result, due to the blocking of the aqueduct of Sylvius, but the only localizing signs are those obtained from a careful ophthalmological examination.

Partial hemianopia was present in six patients. The defects in the field were not so clear cut as they frequently are found to be in cases of perichiasmal tumor or tumor invading the temporal or occipital lobes. The macula was spared in every instance and the area of blindness rarely approached it closely. The defects in the fields were bounded, not by straight lines and angles but by curves. In two cases in which one lateral geniculate body was invaded by neoplasm, a contralateral homonymous defect was disclosed by the visual fields. One patient with unilateral involvement of the lateral geniculate body had a suggestive bitemporal superior-quadrant defect. As a large proportion of the fibers of the optic radiation enter the lateral geniculate body, it is not surprising to find defects in the visual fields.

It was more difficult to explain the hemianopia in three cases of superior-colliculus tumor in which there was no invasion of the lateral geniculate body, the occipital, or temporal lobes. In each instance, the defect in the fields was contralateral to the colliculus involved. A possible explanation was suggested by the findings in one case in which the visual fields were tested only for hand movements, and in which no defect was apparent. This patient had a circumscribed tumor limited entirely to the quadrigeminal region and damaging particularly the left superior colliculus. In his examination of this specimen, Dr. Walter Freeman reported definite compression but no invasion of the lateral geniculate body by a tumor. It is possible that compression of the lateral geniculate body explains the field defect in the other cases of tumor confined to the superior colliculi.

There was choked disc in six cases, blurring of the disc margins in one, secondary optic atrophy in one, pallor of the discs in one, and normal fundi in two. One patient had paralysis of associated upward movements of both eyes and paralysis of the internal rotation of the right eye. The right pupil was fixed to light and accommodation. Post-mortem examination revealed that tumor invaded both oculomotor nuclei as well as the left superior colliculus and left lateral geniculate body. Another patient had a complete right ophthalmoplegia. The right oculomotor nerve sheath was found to be invaded by tumor. Only one patient had an Argyll Robertson pupil. The right superior colliculus, the right lateral geniculate body, and the right oculomotor nucleus were involved in tumor. The diagnostic value of such pupils in cases of mesencephalic tumor has been discussed by Wilson and Rudolf (Jour. Neurol. and Psychopath., 1922, v. 3, p. 140) and Wilson and Gerstle (1929, v. 22, p. 9) who provided evidence that an infiltrating tumor involving the anterior colliculi may produce the Argyll Robertson sign. While it is true that in practically all instances an Argyll Robertson pupil is pathognomonic of syphilis, there is no doubt that in rare instances similar pupillary changes may be produced by an invading mesencephalic tumor and that in these instances the involvement may be unilateral or bilateral. Commenting upon one of the cases, Wilson and Gerstle stated, "The tumor was so placed that the path for the light reflex via the anterior colliculi was interrupted, whereas that for accommodation from the crura cerebri through the tegmentum to the third nerve nuclei was intact." The Argyll Robertson pupil associated with mesencephalic tumor is relatively large, often measuring two and a half to three millimeters, as compared to the small miotic pupil seen in syphilis.

### Papilloma lying within lower canaliculus

Dr. John W. Burke presented W.P.M., aged 74 years, who had a tumor projecting through the punctum of the right eye. It was found to be a papilloma lying in the lower canaliculus. No attachment could be found to the wall. It was removed and the canaliculus sutured with fine silk with complete restoration of function. Pathological examination showed the tumor to be 7 mm. × 3 mm. in size, having fibrous streaks surrounded by squamous epithelium, a thin fibrous capsule, and scattered blood supply.

### Monocular toxic amblyopia from acetanilide

Dr. John W. Burke said that two years ago Mrs. C. G., aged 58 years, had vision of 20/20 in each eye which suddenly dropped to 20/40 in the left eye without apparent cause. The fundi were negative. There was a small central scotoma for color. It was found that the patient had been taking a heaping teaspoonful of bromoseltzer (containing approximately 4 gr. of acetanilide) daily for six months. The bromoseltzer was stopped and at the end of six weeks vision had been restored to normal with no further symptoms.

### Ocular findings in meningo-encephalitis

Dr. John W. Burke said that Mrs. J. T. B., aged 46 years, had been suddenly taken ill with violent occipital headache. The temperature was 101° F. The physical examination was negative. A neurological examination was negative except for slightly exaggerated knee jerks. The spinal puncture showed the fluid to be clear under slight pressure and cell count 56. The diagnosis was meningo-encephalitis, Windber Pennsylvania type. On the third day there was slight elevation of the disc of the nasal half in the right eye,

about one diopter, accompanied by fine petechial hemorrhages into the disc and surrounding retina. The temporal half was negative. A single lumbar puncture was made. Two days later there was the same appearance in the left eye. No further punctures were made as the patient recovered without sequelae.

Ernest Sheppard,
*Secretary-treasurer.*

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## CHICAGO OPTHALMOLOGICAL SOCIETY

March 15, 1937

DR. G. HENRY MUNDT, *President*

### ARTERIOVENOUS ANEURYSM OF THE CAROTID ARTERY IN THE CAVERNOUS SINUS

DR. MAX KULVIN said that this 33-year-old man had suffered a broken jaw (left) in November, 1936, which did not appear to affect his eye. On December 15, 1936, he noted a burning sensation in the left eye; a diagnosis of conjunctivitis was made, and the eye was treated with silver nitrate. During an attack of influenza, which lasted from December 28th to January 8th, the patient noticed for the first time that the eye seemed to protrude. This has been marked at times, and at other times the eye appeared to be normal.

His past history records hospitalization in 1921, for an eye condition resulting from boxing. Since that time he has been in the hospital 36 times because of this condition. In 1931, vision in the left eye was 20/200. There were an irregular pupil, posterior synechia, and lens opacity toward the temporal side. At that time a diagnosis of chronic dacryocystitis and traumatic cataract was made.

When the patient came under observation 10 days previously there were marked proptosis and severe pain; also pulsation, which the patient described as a whistling sensation in each ear with the heart beat. The pulsation could be palpated at the inner upper angle of the left orbit. There was a marked bruit over the left eye and along the left side of the head which could be eliminated by pressure over the left carotid artery. The eyeball was fixed, allowing a very small amount of rotary motion. Vision was little more than light perception. The visual field was almost restricted to the fixation point. The veins over the left side of the head were distended; those in the fundus were slightly dilated and the nerve head was blurred.

An injection of 2-percent gelatin solution subcutaneously has been tried in treatment of these cases. Surgically, ligation of the common carotid is most frequently performed, with a 7.70-percent mortality; ligation of the orbital veins shows a 5-percent mortality. In this case a slow ligation of the common carotid will be attempted. The carotid artery will be isolated with narrow linen tape and daily compression made until the bruit is completely eliminated with no consequent cerebral anemia, at which time the artery will be ligated with a linen thread.

### CONCERNING CONDITIONS SIMULATING AN INTRAOCULAR TUMOR. A CORRELATION OF CLINICAL AND HISTOLOGICAL FINDINGS

DR. BERTHA KLIEN read a paper on this subject which was published in this Journal (August, 1937).

*Discussion.* Dr. E. V. L. Brown recalled a patient presented before the Society in January, 1925, concerning whom there was a general agreement that he had a circumpapillary sarcoma. However, the enucleated eye showed no tumor but Jensen's chorioretinitis juxtapapillaris. The same condition developed later in the second eye, and was reported subsequently by Dr. S. V. Abraham.

Dr. William F. Moncreiff thought that as more studies of this type are carried

on, more accurate clinical methods may be developed for differentiating between intraocular, especially subretinal, tumors and other lesions which simulate tumors.

Dr. Bertha Klien (closing) said in reply to Dr. Michael Goldenburg that the pigment-epithelial cell has phagocytic properties only when it is separated from the epithelium.

AN UNUSUAL RECOVERY FROM ENDOPHTHALMITIS OF MENINGOCOCCUS MENINGITIS.

DR. N. K. LAZAR read a paper on this subject which was published in this Journal (September, 1937).

*Discussion.* Dr. Robert von der Heydt said that he had had a case, not epidemic, but of tubercular meningitis, with recovery. The patient was blind for months with a cloudy vitreous. After years the vitreous strands contracted to such a degree that detachments of the retina occurred. The Kodachrome fundus photo, which was exhibited, showed the connective-tissue strands similar to the ones to be seen in Dr. Lazar's case.

Dr. N. K. Lazar (closing) said that the choked disc on the left side had disappeared as mysteriously as it appeared. Dr. Hoyne could not explain it. Of all the cases seen at Cook County Hospital, very few showed a choked disc. Dr. Hoyne was of the opinion that in this case there was a very severe edema of the brain.

SOME IMPORTANT POINTS IN THE DIAGNOSIS AND TREATMENT OF HETEROPHORIAS.

DR. GEORGE G. GUIBOR presented a paper on this subject which was discussed by Drs. Robert von der Heydt, Max Kulvin, Thomas D. Allen, E. V. L. Brown, S. J. Meyer, and in closing by Dr. Guibor.

Robert von der Heydt

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## MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

### SECTION ON OPHTHALMOLOGY

March 12, 1937

DR. W. L. BENEDICT, *president*

THE EYE IN NEUROLOGY

DR. GORDON R. KAMMAN, Saint Paul (by invitation) read a paper on this subject which was published in this Journal (November, 1937).

*Discussion.* Dr. H. W. Grant, Saint Paul, said he was very much interested in the case report which Dr. Kamman cited, of the four-year-old boy who had a papilledema or encephalitis. It is certainly unusual to see a choked disc following encephalitis, but when it is associated with paralysis of convergence, which is a very common symptom in encephalitis, one should be very suspicious of it. One cannot, however, easily rule out the possibility of a brain tumor.

Another interesting feature is those cases of oculogyric crises that occur in children, which are in all probability a low-grade encephalitis, without any definite history of an acute illness. They do not, of course, fall into the characteristic picture of acute epidemic encephalitis. In chronic progressive nuclear paralysis, of which Dr. Kamman spoke, Dr. Grant thought that one occasionally sees cases of carcinomatosis that involves the third-nerve nucleus so slightly as sometimes to produce the picture, although one is unable to determine any evidence of a primary growth. There may be, however, some evidence of fever when a neoplasm is present.

Dr. H. P. Wagener, Rochester, said a number of problems were presented which are met with in everyday practice. Probably the most interesting part of the as-

sociation between neurologists and ophthalmologists lies in the discussion of atypical cases. One problem arises in cases of choked discs in the absence of symptoms and findings definitely diagnostic of brain tumor. It is often difficult to decide in these cases just why the patient has choked discs and whether it is better to adopt conservative medical or radical surgical procedures in the attempt to reduce the edema of the discs.

Another problem arises in connection with cases in which the diagnosis of optic neuritis is fairly clear, but no definite cause for the neuritis can be demonstrated. In cases of optic neuritis associated with multiple sclerosis, the problem of treatment is important. From the ophthalmologist's standpoint, active treatment of the optic neuritis seems advisable. The immediate effect of foreign-protein therapy or sweats, for example, seems to be favorable in these cases. From the neurologic standpoint, however, it seems very questionable whether these types of treatment have any actual effect, either on the primary manifestation of optic neuritis or on the subsequent course of the disease. It is true that ophthalmologists see many cases with a history of previous transient loss of vision and with opthalmoscopic evidence of previous optic neuritis in which the vision has returned to normal or essentially so without treatment. The recognition of these facts raises the question as to whether the patient with optic neuritis in the course of multiple sclerosis should be subjected to the expense of hospitalization necessary for active treatment of the neuritis.

Another group of cases which present points of interest to both ophthalmologists and neurologists are the vitamin deficiencies, especially the neurologic and ophthalmologic syndromes of vitamin-B deficiency. The neurologist is usually more alive than is the ophthalmologist to the possible etiologic role of vitamin-B deficiency in cases of optic neuritis, ocular muscle paralyses, and hemorrhages in the retina, especially if they are associated with peripheral neuritis. Of particular interest are the cases of optic neuritis and retinitis associated often with polyneuritis in pernicious vomiting of pregnancy. Vitamin-B therapy has produced decided improvement in a number of these cases.

Still another interesting problem is presented by the group of cases generally spoken of as progressive ophthalmoplegias. Proper neurologic classification of these cases into the myotonias and amyotonias or myasthenias may permit of considerable improvement in symptoms through the use of the proper remedy, quinine or prostigmin.

Dr. Kamman, in closing, said the reason he dodged the subject of optic neuritis was that he had just as much trouble classifying it as anybody else does. The word "idiopathic" is a very convenient cloak for ignorance and its use must necessarily be invoked when discussing certain cases of optic neuritis. The concept neuromyelitis optica is similar to that of disseminated sclerosis, and the thought is that in the former condition one is dealing with a pathological process identical to that of the latter but limited to the optic nerve or the optic chiasma.

Whether or not one should treat every case actively is, of course, debatable. Dr. Kamman said that whenever a patient presents himself with that condition, he always tries to put himself in the patient's place. He would want some form of treatment, if for nothing more than the mental comfort he might get from the knowledge that something was being done for the trouble. He sometimes employs quinine or sweats. He said the reason he hesitates to use foreign-protein therapy is because there recently has been some evidence advanced from animal experimentation that this form of treatment tends to promote thrombosis of the venous capil-

laries in the central nervous system, and may aggravate the lesions of disseminated sclerosis.

The condition of vitamin deficiency is as yet imperfectly understood. At one time it was thought that polyneuritis gravidarum was due to a loss of vitamin B through the hyperemesis gravidarum. However, McKinley and Berkwitz, at the University of Minnesota, reported a case of polyneuritis gravidarum in which there had been no vomiting. There have been some cases of asthenopia which improved on a high-vitamin diet.

In answer to Dr. Larsen's question about the treatment of multiple sclerosis, Dr. Kamman said that this depends upon where one went to school. In some centers fever therapy is advocated and in others it is condemned. Some neurologists are enthusiastic about quinine, others merely lukewarm. Again, putting himself in the patient's place, Dr. Kamman said that if he had disseminated sclerosis he would take quinine by mouth, a high-vitamin diet, intramuscular injections of sodium cacodylate, and stay in bed. If there was no amelioration of symptoms in a few weeks, he would ask for some foreign-protein therapy.

Walter E. Camp,
*Secretary.*

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## COLLEGE OF PHYSICIANS OF PHILADELPHIA

### Section on Ophthalmology

### March 18, 1937

Dr. Charles R. Heed, *chairman*

#### An industrial problem connected with light and dark adaptation

Dr. Edmund B. Spaeth read a paper on this subject which appeared in the Archives of Ophthalmology, v. 18, p. 248.

*Discussion.* Dr. Francis Heed Adler called attention to the fact that each determination was made immediately after exposure to the artificial firebox. It would not be likely that under actual conditions the signals would come each time after the fireman had looked into the firebox. Unless there were data of how often signals are presented and how often the firebox must be opened one could not tell what the chances were of these two coinciding, and since the scotoma lasts a relatively short time he did not believe that this is the main reason why so many signals are missed.

Dr. Spaeth (in conclusion) said that firing conditions were averaged on the short runs. Some firemen averaged a 20-percent cut in salary for fines inflicted when they failed to pick up a signal. They are disciplined by fines. On the longer runs where miles intervened without signal lights that, of course, would not apply.

#### Pathological changes in the filtration angle in simple glaucoma

Dr. Perce DeLong presented a review of the pathological processes and changes in the filtration angle.

#### Contribution to the theory and practice of tonometry

Dr. Jonas S. Friedenwald said that tonometric measurements are not direct measurements of intraocular pressure but are measurements of the degree of indentation of the cornea produced by the tonometric plunger with a given load. As was noted by the earliest writers on tonometry, this measurement is a function not of intraocular pressure alone but is influenced by other factors of which the distensibility of the eyeball as a whole is the most important, since an indentation of the cornea with no net loss of intraocular fluid must be associated with a stretching of the ocular coats elsewhere. If we compare two eyes which actually have the same intraocular pressure but which differ markedly in the rigidity or distensibility

of their coats, we will erroneously conclude from the tonometric reading that the pressure in the more rigid eye is higher than in the more distensible eye. The present study represents an attempt to disentangle these two factors in the tonometric reading.

A study of the experimental data reported by others on the distensibility of the eyeball leads to a simple mathematical relation between volume and pressure in any given eye from which a coefficient of rigidity can be determined. If we could distend the eye by two different amounts and determine the pressure at these two different degrees of distention, we could determine the coefficient of rigidity of the eye. The studies which Schiötz undertook in calibrating his tonometer enable us to calculate the volume of corneal indentation corresponding to any given scale reading of the tonometer; namely, the volume by which the eyeball is distended, and also the actual pressure in the eye carrying the tonometer. By making tonometric readings with two different weights, we are thus able to determine the coefficient or rigidity of any eye and to arrive at a correct estimate of the intraocular pressure.

The results of this analysis indicate: (1) There is a systematic error in the Schiötz scale. The intraocular pressure is actually somewhat higher than the Schiötz scale indicates, a finding that is in agreement with the new comparisons of tonometric and manometric measurements that have been made on living eyes. (2) Clinically significant readings on ocular rigidity can be made. (3) The rigidity of the eye increases with age and its measurement is influenced by axial refraction, corneal curvature, and by certain drugs. In glaucoma, after a prolonged period of high tension, the rigidity is abnormally high but in glaucoma with controlled tension, the rigidity is normal. The rigidity of the eyeball is, therefore, an effect of glaucoma rather than a cause. In extreme myopia, the rigidity of the eye is abnormally high, indicating that the coats of the eye have been stretched beyond their elastic limits.

*Discussion* Dr. Friedenwald (in conclusion) said in answer to Dr. Francis Heed Adler and Dr. Alfred Cowan that since we have chosen for our coefficient of rigidity the relation between the change in intraocular pressure to a measured change in intraocular volume, it is to be expected that small eyes, although they have perfectly normal ocular conditions, will show a higher coefficient of rigidity than large eyes. The same measured change in volume is proportionately greater in the former case than in the latter. For instance, the coefficient of rigidity, as determined from the experiments of Clark, previously referred to, is greater in monkeys than in cats and greater in cats than in dogs, as is to be expected from the difference in the size of the eyeballs of these different species. One would anticipate, therefore, that hyperopic eyes and eyes with a small radius of corneal curvature would have a higher coefficient of rigidity than myopic eyes and eyes with a large radius of corneal curvature. This relationship was found to hold as predicted, except in the case of extreme myopia, in which the distensibility of the eyeball is less than the large size of the eyeball would lead one to predict. The cause of this relative increase in the rigidity of the eyeball in extreme myopia has not been ascertained. The possibility that the sclera in these cases has been stretched beyond its elastic limit, is merely suggested; however, other explanations may be advanced which are at least equally reasonable.

A. G. Fewell,
*Clerk.*

## OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM (ANNUAL CONGRESS)

April 29, 30, and May 1, 1937

DR. GORDON HOLMES, *president*

### PROGNOSIS IN PAPILLEDEMA

DR. GORDON HOLMES said that papilledema is one of the common conditions which constitute a meeting ground for the ophthalmologist and the neurologist. No aspect of the condition demands more attention than its prognosis in regard to preservation of vision. The purpose in this address was to discuss only the form of papilledema which is associated with increased intracranial pressure.

With regard to the pathology, it is now recognized as, essentially, an edema of the nerve head, in which, at least for a time, there is little structural damage or functional disturbance of the nerve elements. The nerve fibers might be strangled and destroyed by overgrowth of interstitial tissue when the edema subsides. In this latter stage it is not reasonable to expect the vision to recover. The essential etiological factor in papilledema is increased intracranial pressure, therefore relief from that pressure would remove the risk of blindness or serious deterioration of vision. How long, he asked, can measures for relieving pressure be delayed without endangering vision? A general answer to that question is not at present possible; each case must be separately adjudged. Even intense edema may not cause any disturbance of vision, indeed, vision may remain unimpaired for long periods. In rare cases the papilledema subsides without surgical intervention or other specific treatment and vision remains unaffected. In most of those cases it is impossible to ascertain the exact nature of the condition to which the papilledema is due; in some there may be a tuberculous or gummatous tumor which became quiescent, or a gliomatous growth which degenerated. But internal hydrocephalus is probably responsible in many of them for the elevation of intracranial pressure. In others there may exist external hydrocephalus or serous meningitis.

In most cases relief of intracranial pressure is necessary in order to save sight. The more rapidly the congestion and swelling of the optic disc develops the more intense the papilledema becomes, and the greater the danger to the sight if no relief is undertaken. A swelling of four or five diopters is a warning against undue delay. Equally serious is great engorgement of the retinal veins and early and extensive hemorrhages on the surface of the swollen disc. An even more important sign is a narrowing of the arteries of the swollen disc and its vicinity. Frequent examinations should be made, in order to evaluate the fundal changes and detect the earliest signs of secondary atrophy. A further serious sign is the transient loss of sight, of which many patients complain. This may follow sudden changes of posture.

If the tumor or other cause of the increased pressure can not be extirpated, a decompression craniotomy usually causes subsidence of the congestion in from two to four weeks, and if by that time secondary changes have not appeared, there is no further risk of impairment of vision.

### RETINAL CIRCULATION: CHANGES IN METABOLIC DISEASE

DR. A. E. MACDONALD, of Toronto, summarized his conclusions: (1) papilledema, which is indistinguishable from that associated with brain tumor, occurs in some cases of metabolic disease; (2) in the latter the eye is subject to toxins in equal degree to other parts, but the outstanding retinal changes can not be explained by toxins, arteriosclerosis, or inflammation; (3) obstruction of the ocular

drainage occurs with either an explosive, a slow, or an intermediate time-factor for its development; (4) venous distension at the disc occurs late in systole, and disappears when the intracranial pressure is raised to about 250 mm. of water or 18 mm. of mercury; (5) straining, lifting, coughing, holding the breath produces a rise of the intracranial pressure sufficient to cause obstruction of the central vein; (6) rippling of the light reflex on the retina, pin-point brilliant spots, dilatation of the capillaries, blurring of the disc border, may be interpreted as indicating increased intracranial pressure.

### Observations on catholysis in treatment of retinal detachment

Mr. R. Foster Moore said his purpose in presenting this small series of 31 cases was to describe the technique of catholysis and the results arrived at a short time afterwards, rather than to attempt to assign to the method its due importance in practice. The object of the procedure was to produce coagulation in the choroid as a result of the liberation of sodium ions at the negative terminal inserted through the sclerotic. At the same time, hydroxyl ions were set free, as was readily evident by means of the ophthalmoscope during the operation. The instrument used by him was either straight or bent at a right angle. The length of the active part of the needle varied from one millimeter upwards; the needles were made of platinum iridium. They could easily be passed through the muscles to the globe, for which purpose the needles must be four to five millimeters in length. In his opinion the best strength of current to use was five milliamperes, and he usually passed it for six seconds. An almost unlimited number of punctures could be made, even though the eye might be somewhat soft. The flaccidity might render subsequent trephining difficult. Bubbles of gas were seen at the site of the puncture, and from the punctures there was always some escape of fluid; when the latter was free, no additional exit might be needed for the subretinal fluid. It was better to make a definite hole, however, by trephining with the galvanocautery.

Of the 31 patients, 14 were myopic. In 12 of them the retina was replaced and remained in position when the patient was last seen. Two were discharged slightly improved, four much improved, nine not improved. Still, the longest period since the treatment did not exceed 12 months, and in the case of a number it was not more than a few weeks.

With regard to the advantages of the method, a light, portable, and an easily used apparatus was employed, its effects were sharply localized, and less damage was done to intraocular tissues than with diathermy. It was unnecessary to divide the muscles unless it was required to expose the sclerotic far back. But, he said, the crucial test was not the number of cases in which the retina went back, but in what proportion the replacement was permanent. To that question the speaker had not yet an answer.

### Criticisms and comments on newer methods of treating detachment of the retina

Mr. J. Cole Marshall remarked that in catholysis the whole length of the needle was active, whereas in diathermy the only active part of the needle was its base, and often the point became cool. And in catholysis a retinitis was formed beyond the region where the bubbles had been liberated, so that when the retina returned to its normal position the retinitis in that region might produce changes in the choroid. If an intensive retinitis was produced the question arose as to whether

that would help to keep the retina in position. The practice of Mr. Foster Moore was to retain the needle in the eye longer than most Continental workers did, and he also used a slightly stronger current. He fully agreed that catholysis was a good localizing agent, and it was also a good adjunct to diathermy scarring. In cases of detached retina Mr. Cole Marshall had found catholysis very beneficial when he used it in conjunction with diathermy, and for the latter the use of very fine needles represented a distinct advance. The transillumination method favored by Weve and described by him the speaker regarded as very important, as also was the continuous use of saline on the cornea during the operation, this being applied every minute during the procedure.

EXOPHTHALMIC OPHTHALMOPLEGIA

DR. W. RUSSELL BRAIN said the condition is characterized by exophthalmos and ophthalmoplegia, and it may be either unilateral or bilateral. When it arises spontaneously it is associated with general symptoms of thyrotoxicosis, though the latter are slight in most of the cases. It may follow thyroidectomy for hyperthyroidism, in which case general symptoms of thyrotoxicosis are often absent, the basal metabolic rate being normal, or it might even be subnormal. The separation of it as a syndrome from exophthalmic goiter depends on a number of features, the most important being that it may occur postoperatively, even in the presence of hypothyroidism. It also differs from Graves's disease in its age and sex incidence, in the usually slight degree of thyrotoxic symptoms, in the lack of response to thyroidectomy, and in the rather atypical histological picture presented by the thyroid. Exophthalmic ophthalmoplegia is essentially a disorder of middle age. It is usually subacute in onset, one eye becoming increasingly prominent over a period of three to four months; the ophthalmoplegia and the double vision develop concurrently. Both exophthalmos and ophthalmoplegia may develop simultaneously in both eyes in three or four months. Ophthalmoplegia was present in all his cases: unilateral in five, bilateral in 24. In the latter the exophthalmos was equal in eight cases, unequal in 16. The ophthalmoplegia was unilateral in 12 of the cases, bilateral in 17; it was really mostly a paresis of the eye movements in a particular plane. In six patients all the movements of both eyes were affected.

Dealing with the pathology of the ocular muscles and the thyroid, Dr. Brain said the changes consisted of marked edema, with foci of lymphocytic infiltration, and, in later stages, fibrosis. In a piece of levator palpebrae superioris removed at operation which was submitted to Professor Turnbull general edema was found and great enlargement of muscle fibers. In four out of five cases sections of the thyroid gland showed the gland to be atypical, and in the other case the gland was in the condition found in cases of Graves's disease.

With regard to treatment, in his experience the treatment usual in exophthalmic goiter was disappointing when applied to cases of exophthalmic ophthalmoplegia. In four of his cases thyroidectomy was carried out. In one of them marked general improvement occurred, with a considerable improvement in the condition of the eyes, though there was some remaining ophthalmoplegia. Following orbital decompression there occurred an immediate recession of the eye but in one case the ophthalmoplegia remained unchanged; in the other two, there was a moderate benefit in this respect. He was hoping for the day when the condition could be dealt with more physiologically than by means of surgery.

### Prostigmin in exophthalmic ophthalmoplegia

Professor F. R. Fraser read a communication on the subject in which he concentrated on the effects of prostigmin in two cases of the condition. It had been shown that acetylcholine was essential to the production of nerve impulses across the ganglia of the sympathetic system, and for transmission of impulses from the vagus nerve to the effector organs of the vagus system, as well as for the transmission of nerve impulses from nerve endings to voluntary muscles. But the substance was rapidly destroyed in the body; namely, in the presence of choline esterase. Dr. Mary Walker had recently shown that a synthetic analogue of physostigmine, known as prostigmin, restored voluntary muscle in cases of myasthenia gravis. Within a few minutes of its subcutaneous injection its effect was evident, while in a few hours the effect had passed off. This action was due to the inhibition of prostigmin by the esterase.

The first of the two patients was a woman aged 41 years, who, at 26 years of age, began to show signs of toxic goiter; namely, tremors, palpitation, and marked sweating. A year later she developed exophthalmos, more marked on the right than on the left side, diplopia, and a pronounced ptosis of the left upper eyelid. The ophthalmoplegia developed rapidly and interfered with her work, that of a school teacher. At this stage she had a drooping of the eyelid which was intensified towards the end of the day, and it was more severe at the end of the school term. In 1925 partial thyroidectomy was carried out, and after that the ophthalmoplegia became much better, and the ptosis on the left side was so much improved that she was able to resume her teaching. But her tachycardia and tremor never disappeared. She was therefore treated with prostigmin, a milligram of atropine having been previously given. Twenty-three minutes after using the atropine 2.5 mg. of prostigmin was given (a large dose) but the upsetting effect was neutralized by the atropine and four minutes later there was improvement in the upward vertical movement of the right eye. In a few minutes the axes of the eyeballs became parallel on looking straight forward, there was twitching of the orbicularis, and diplopia was present only when she looked upward. Some 17 minutes after the injection diplopia was present only when the patient carried out extreme upward elevation of the eyes. At that stage her condition began to retrogress a little, as shown by the fact that diplopia could be elicited more easily, and after half an hour the axes were again deviated. The patient said that during the remainder of the evening her eyes were stronger. A week later a similar dramatic result was brought about in the same manner.

The second patient was also a woman aged 41 years, and she developed her goiter when 32, beginning with a lack of energy and a feeling of weariness. A year later there was exophthalmos, but no severe toxicity. Later there was diplopia. In 1930 thyroidectomy was performed, and since then the ophthalmoplegia had remained stationary. During the last few years she had been treated with thyroid because of her feeling of lassitude and general depression, and in the last year the exophthalmos had increased to a greater degree than at any previous time. Prostigmin was used, but in this patient it had no effect. The difference in result in these two cases suggested a different pathology in them, or it meant that the disease process in the second patient had progressed so far that it could not respond.

### Exophthalmic ophthalmoplegia

Mr. H. B. Stallard said his patient was a man aged 31 years, whose com-

plaint was that when looking upwards, and also when he opened his eyes after keeping them closed two or three minutes, he had diplopia. His condition was becoming progressively worse. He had a tired feeling in his eyes, general lassitude, was nervous and easily worried. Bilateral exophthalmos was evident, more marked on the left side. The thyroid was slightly enlarged, soft, and uniform in consistency. The pulse rates were 64/90, the reflexes brisk, the basal metabolic rate —40 percent. No abnormality was found in the blood count nor in radiographs of the skull. There was a negative Wassermann reaction. The lymphoid tissue in the pharynx was said to be inflamed. Injection of 600 organon units of the thyrotropic hormone of the anterior lobe of the pituitary was given on three successive days. The metabolic rate rose from 3 percent to 21 percent within 24 hours of giving the first injection and there was a further rise to 30 percent after the second and third injections. In the 12 hours following injection the temperature rose, as did the pulse and respiration rates; also there were frontal headaches. Then the patient slept, and next morning the headache was only slight. Three weeks later a corneal ulcer developed in the left eye, and in spite of various measures the patient lost the sight.

(Reported by H. Dickinson.)

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## CORNEAL AND CONJUNCTIVAL HERPES

It is not many years since dendritic keratitis and several rather similar corneal diseases were attributed to some sort of nervous disturbance remote from the eye, and, for want of more intimate knowledge, were spoken of as "neurotrophic" disorders. The more protean and more spectacular herpes zoster, as seen in the eye or elsewhere, was often attributed to an obscure infection of the nerve ganglia.

At the turn of the century an important group of clinicians attributed dendritic keratitis to malaria. Thus, writing in 1899, from a district where malarial infection could be found in a large percentage of the population, Ellett declared his belief that dendritic keratitis was almost entirely dependent on malaria, as verified by blood examinations. Kipp had already given the name "malarial keratitis" to this lesion.

It now seems probable that several of these formerly obscure conditions are due to an ultramicroscopic virus of varying effect and varying malignity. As far back as 1912, William Grüter discovered that some of these corneal eruptions contained an infectious material, inoculation of which into the abraded or incised cornea of rabbits led to a disease process resembling that of the human cornea. Grüter first published his early findings in 1920. The remote implications of his investigations have a significance which extends far beyond the bounds of ophthalmology.

The process developing in the rabbit cornea after vaccination with material from human dendritic keratitis or corneal

herpes bore a striking resemblance to the human disorder. Within fifteen to twenty hours the scratched area of the rabbit cornea showed extremely fine gray dots which took a fluorescein stain. From these minute infiltrates developed thin buds, advancing into the healthy tissue. The further extension of these sprouting lesions was accompanied by reduction in corneal sensibility. The disturbance in the rabbit cornea reached its acme in seven or eight days, then gradually subsided to leave a diffuse scar. Repeated transmission of the virus was possible from the second day, transmissibility was at its maximum on the third and fourth days, and this quality was lost on the sixth day. The result of inoculation was negative if the vaccination material had been cooled below 46° or heated for a half hour to 132° Fahrenheit.

Later investigations have shown that the same virus is contained in the bleb of labial herpes (the fluid from which is active in a dilution of 1 to 1000); and that in addition to a dermotropic it also possesses a neurotropic quality.

The affinity for the nervous system expresses itself in the fact that inoculation of a sufficient dose of the virus into the rabbit cornea may lead to cerebral in addition to local changes, and under suitable circumstances to the death of the animal. By carrying the virus through a stage of cultivation in the brain of the living rabbit, the neurotropic quality may be enhanced to such a degree that application of the intensified virus to the cornea of other rabbits gives rise to severe changes in the brain.

There is apparently some ground for believing that the difference between the virus of simple herpes and that of herpes zoster is merely one of virulence, the malignant qualities of the zoster virus depending upon its intense neurotropism.

The most interesting feature of later investigation as to the herpetic virus is its probable connection, not merely with dendritic keratitis, but with a variety of formerly obscure corneal lesions including disciform keratitis, certain cases of relapsing corneal erosion and of bullous and filiform keratitis, and also cases of superficial punctate keratitis and deep keratitis. Outside of the eye the same virus has been blamed for impetigo contagiosa. Szily, using a special technique for inoculation into the ciliary body, claims to have produced an intraocular inflammation of the second eye which may have a bearing on the etiology of sympathetic ophthalmia.

Schieck, whose monograph on the diseases of the conjunctiva, cornea, and sclera (Kurzes Handbuch der Ophthalmologie, 1931, volume four) contains a fascinating review of the herpetic group of corneal diseases, points out that we must not be too ready to assume that every case of superficial punctate keratitis, or of the various other corneal disorders just referred to, is of herpetic origin. Not all clinical changes recognized under a certain title rest upon a single, invariable etiology.

It should be mentioned that some writers do not agree as to the essential identity of the virus of simple herpes and herpes zoster, but attribute the latter disorder to the virus of chicken pox, inoculation of which, after passage through the rabbit brain, has produced typical herpes zoster in the human subject.

In 1931 Larsson and Granström reported a case in which the principal symptoms were unilateral membranous conjunctivitis, dendritic keratitis, swelling of the preauricular gland, and a general rise of temperature. Inoculation into rabbit eyes produced a similar complex, and the disease picture was transmitted through several generations of rabbits. Bacteriological examinations, on the other hand, were without definite results. No conclu-

sion as to the etiology was then arrived at, beyond a vague association with the group of disturbances to which the title of "Parinaud's syndrome" had been attached.

Within the past four years a number of cases of membranous conjunctivitis have been reported by Löwenstein and Aust, with evidence (by cultivation and animal inoculation) that they were due to the virus of herpes. Granström now states that in his opinion the case described by him and Larsson in 1931 was due to infection with the herpes virus. Such a conception of the case was previously obscured by the fact that the membranous conjunctivitis was an earlier and more striking symptom than the dendritic keratitis. But it will be seen that evidence in favor of Granström's present conclusion had been furnished by the positive result of inoculation into the rabbit cornea.

Granström also reports several further cases of membranous conjunctivitis with corneal complications and in most of which animal inoculation produced similar results. In any such investigation, however, it must be borne in mind that positive results from animal inoculation are not likely to be obtained in the later stages of the disease.

It seems therefore to be rather clearly proved that we must recognize not merely corneal but conjunctival herpes. The latter may or may not be complicated by involvement of the cornea. Superficial punctate keratitis may appear as a preliminary stage of typical dendritic keratitis, or of disciform keratitis.

About two years ago, at the time of publication of the large volume edited by Frederick P. Gay under the title of "Agents of disease and host resistance," seventy major diseases had already been attributed to filterable viruses. The field of investigation in regard to virus diseases widens steadily. Probably no other field of medicine is at present exciting so great a stir of scientific curiosity and investigation. W. H. Crisp.

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## ASTHENOPIA WITH CONVERGENCE

At the first scientific meeting of the American Ophthalmological Society, in 1865, Ezra Dyer, of Philadelphia, read a paper entitled, "Asthenopia not connected with hypermetropia." In his case there was myopia, more or less marked. Only one patient had astigmatism. The paper, based on forty cases, was read to call attention to the method of treatment, which had given relief in thirty-eight of them. The treatment was systematic gymnastic exercise of convergence with lenses, usually concave, that allowed more accommodation, with less convergence. The exercises were kept up each day, with carefully limited periods that were gradually lengthened. Dyer regarded the cause of the asthenopia as some disturbance of relative accommodation. The patient was kept using the glasses for the exercises, until he could read an hour and a half with them, three time a day; and then was permitted gradually to read without them.

This paper was discussed by the president of the society, Dr. Delafield, and by Dr. Hasket Derby, who had studied with Donders, and who called attention to the original division of asthenopia into two great classes: one, in which the continued use of the eyes is physically impossible; and two, where it is optically impossible. The paper was also discussed by E. Williams of Cincinnati, and H. W. Williams of Boston. All had seen this type of asthenopia, and agreed that the cases grew worse when the eyes were not used. The method of treatment described by Dyer was tried by many of his contemporaries and was called "Dyerizing." But the book of Donders on "Accommodation and refraction of the eye" was then attracting

the attention of most ophthalmologists. The correction of errors of refraction became their chief occupation, and the views of Dyer easily forgotten. Outside of America very little attention has been paid to them.

Since then, Stevens started an era of heterophorias, to be cured by graduated tenotomy. Maddox invented his double prism and rod for testing the muscle balance. Treacher Collins pointed out that we owed our binocular vision and binocular movements to our "arboreal ancestors." Professor Elliot Smith found that with binocular vision and movements came the development of the macula in the retina, and the cerebral convolutions of the human brain. Miss Ida Mann and others ascertained that the macula and the coordination of binocular movements have to be developed after birth. Harlan pointed out that myopia began and was made progressive by excessive convergence. Snell has found in his early myopia cases that there is a tendency to excessive convergence.

Now comes Stutterheim with his book on "Eyestrain and convergence" (see this Journal, 1938, p. 77), and a new method of removing the eyestrain by a new system of exercise that will strengthen the extraocular muscles and cure the asthenoconvergence. He has found, although admitting that correction of ametropia is the larger part of the work of an eye physician, that eyestrain is closely connected with convergence. We, who have thought of it as chiefly depending on anomalies of refraction and accommodation, will have to reconsider this, and think of asthenopia as due to anomalies of "relative accommodation" and convergence.

The method of exercises with prisms seems reasonable and rather simple. Noyes practised it thirty years ago. It certainly is worthy of further trial, and more likely to give relief than the stereoscopic and more elaborate machinery that is now being forced on our attention. The improvement of ocular movements depends but little on getting stronger muscles. It has more to do with improvement of coördinations, with better nerve paths; and these are developed by the exercise of voluntary nerve impulses. It is probable that in South Africa the proportion of people who strain their eyes by using poor light for reading and fine needle work is smaller than in this country or Europe.

On the other hand, the number who have not trained their eyes in childhood to quick, accurate movements by games and mechanical handicrafts may be larger. But in America we have a certain number of asthenopic patients and cases of migraine that are not relieved by correcting lenses. For these, prisms have often given relief in the past; and the method worked out by Stutterheim should not be ignored.

The eye physician does not like to adopt a method that will require his daily, or frequent attention. He would rather put it in the hands of a technician trained to do the work. But the general experience with orthoptic training for muscular anomalies seems to show that educational methods to establish and perfect binocular movements and coördinations are most successful when carried out under the immediate care and encouragement of the physician who prescribes them. Dyer found the asthenopia he recognized to be chiefly confined to the upper social classes. The nervous readjustment of such people often depends wholly on the personality and determination of the physician in whom they have confidence.

Edward Jackson.

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## LOUISA LEE SCHUYLER

Ophthalmology has pioneered in many fields, but in none more significantly than in that of preventive medicine.

One hundred years ago was born

Louisa Lee Schuyler, an exceptional woman with vision far beyond the ordinary, who made such important contributions to the prevention of blindness that shortly before her death she was selected by the National Society for the Prevention of Blindness, of which she was one of the founders, to be the recipient of the Dana Medal for outstanding contributions in this field. It is fitting that more than passing notice of this anniversary of her birth should be taken.

Miss Schuyler had been actively interested in matters of social welfare for many years when in 1908 she read an extensive report by Dr. Park Lewis on the condition of the blind in New York State. Twenty pages of this report had to do with the prevention of blindness, and of particular significance to her was the statement that a large part of the existent blindness could be avoided. She focused her attention on one feature, that of the unnecessary blindness caused by ophthalmia neonatorum. She appealed to Dr. Lewis to point out to her what she could do to help, and within six weeks she had organized the New York State Committee for the Prevention of Blindness and had succeeded in getting a subsidy of $5,000 from the Russell Sage Foundation.

The first efforts of the organization were directed towards disseminating the knowledge of the prophylactic action of silver nitrate in preventing gonorrheal ophthalmia when instilled into the eyes of babies at birth. Very quickly other possibilities for blindness prevention were recognized, and the committee entered upon other tasks. In 1915 the name of this committee was changed to The National Committee for the Prevention of Blindness, and its scope was enlarged to fit the name. In 1928 the National Committee became the National Society, and one year later was instrumental in organizing the International Association for the Prevention of Blindness.

Other achievements of this remarkable woman were the founding of the New York State Charities Aid Association; establishing the system of state care for the insane in New York; and aiding the establishment of the first training school for nurses at Bellevue Hospital.

In 1915 she was awarded the degree of Doctor of Laws at Columbia University. She was a remarkable figure, and a tribute should be paid to her on her hundredth anniversary.

Lawrence T. Post.

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## BOOK NOTICES

STUDIES OF THE VIII NERVE. By the Research Study Club of Los Angeles. Clothbound, 268 pages, illustrated. St. Louis, Laryngoscope Press, 1937.

The fifteen papers composing this symposium, were written by fourteen authors; some by two in collaboration. They have for the most part been published in the Laryngoscope; although one comes from the Transactions of the American Ophthalmological Society. Two of the papers, on "Lesions of the cerebellum," 48 pages, and on "Flying blind," 15 pages, with the Foreword, on the history of the Research Study Club, have not previously been published. The volume is in good type, well printed, and neatly and substantially bound. It will all be of interest to those who practice both ophthalmology and otolaryngology, and has some features that will interest those who practice only ophthalmology.

The eighth nerve has been so designated only in the last century. Before that it was called the *nervus acousticus;* or, as Winslow called it, the *portio mollis* of the seventh cranial nerve, the facial nerve being the *portio dura.* In general, throughout medical literature, it has been called the auditory nerve; and the ear has been recognized as only an organ of

hearing. The experiments of Flourens, showed that the semicircular canals were intimately associated with the maintenance of equilibrium. Since then study of the evolution of the vertebrates seems to show that equilibration was the primitive function served by it. The ear of the higher vertebrates shows the cochlea; but fish and other primitive vertebrates are destitute of a cochlea. It is now thought that hearing has been added to the function of equilibration.

In man, and some other mammals, the power of recognizing position and maintaining equilibrium is most dependent on sight. But when sight is lost, by darkness or closure of the eyes, the primitive function of the semicircular canals becomes of great importance, taking the place of sight, or often leading to confusion in our estimates of position and balance. This causes accidents ascribed to vertigo or mental confusion. This aspect of the physiology of the eighth pair of nerves is important enough to command the attention of all ophthalmologists; and this book brings together a wide collection of basic information about this nerve and its functions.

Edward Jackson.

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LES ARACHNOÏDITES OPTO-CHIASMATIQUES. An ophthalmologic and neurosurgical study. By J. Bollack, M. David, and P. Puech. Report presented to the Société Française d'Ophtalmologie, June 29, 1937. Paper covers, 300 pages, with 76 illustrations in the text. Paris, Masson et Cie publishers, 1937. Price not given.

This is a publication of the Société Française d'Ophtalmologie, a further member of the series which has included brilliant and beautifully illustrated works on biomicroscopy, on intracapsular extraction, and on radiography in ophthalmology. All of these works have been prepared as reports to the French society at its express request. The present "report" constitutes the beginning of the annual volume of transactions of the Society for 1937.

The conception of opto-chiasmatic arachnoiditis as a disease entity is relatively recent. Henri Claude speaks of circumscribed serous inflammation of the cerebral arachnoid and pia mater. Study of the condition has been made possible by the modern technique of approach, with greatly reduced risk, to an intracranial region which had previously remained unexplored in the living subject.

In 1929 Cushing and Eisenhardt called attention to the possibility of a "chronic cisternal arachnoiditis" as simulating tumors of the suprasellar region. At the International Congress of Ophthalmology at Amsterdam in 1929, Cushing wrote on the "Chiasmal syndrome with normal sella turcica."

Later knowledge is likely to lead to more detailed classification. Sixty percent of the cases are found between the ages of twenty and forty years, with a maximum number between twenty and thirty years. In 1929 Balado reported the case of a patient affected by optic atrophy of probably traumatic origin, with bitemporal contraction of the visual field, in whom operation disclosed arachnoidal thickening at the level of the cisterna. Splitting of the sheath of the optic nerve was followed by improvement in vision.

The etiologic factors, some of which are not yet well elucidated, include infections of the nasal sinuses, cerebromeningeal infections, and traumatism. In some of the cases reported, an encephalitis was found at operation. Without denying the existence of inflammatory opto-arachnoiditis in elderly patients, the authors believe that usually these are really cases of arachnoiditis associated with lesions of the basal arteries. In such cases the functional outlook is bad; surgi-

cal intervention does not lead to improvement and is hazardous as to life.

Nonsurgical treatments considered include cyanide of mercury (with either positive or negative Wassermann), the iodides, and X rays.

Favorable surgical results have occurred especially in cases of relatively recent onset, in which the visual acuity was not greatly reduced or had only been reduced for a short time; in which the visual fields did not present extensive peripheral or central changes; and in which the disc did not show much atrophy. Results have been unfavorable in cases of long standing, with very poor or no visual acuity, marked visual-field changes, and an atrophic disc.

The volume is well illustrated, with numerous X-ray reproductions; and the text is supplemented by tabular analysis of 63 cases in the literature and 66 French cases here published for the first time; as well as by an extensive bibliography.

W. H. Crisp.

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A TEXT-BOOK OF OPHTHALMIC OPERATIONS. By Harold Grimsdale and Elmore Brewerton. Third edition, clothbound, 322 pages, 105 illustrations. Baltimore, William Wood and Company, 1937. Price $6.00.

This is the third edition of an excellent textbook. The second edition was printed in 1920, and in the present volume the same system of classification and diagrammatic illustrations is used. The special new feature is the surgery of retinal detachment.

In the preface the authors state that the space devoted to historical operations has been curtailed, and instead more details of operations have been included.

The book impresses the reviewer as essentially sound and of value especially to the student of ophthalmology. It obviously is not all inclusive, as, for example, the subject of the handling of a dislocated lens mentions nothing of the aid given by the use of fluorescence, with which adjunct the statement, "Dislocated lenses are usually regarded as almost inoperable," loses its point.

There are many references and a good index.

Lawrence T. Post.

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INTRODUCTION TO PHYSIOLOGICAL OPTICS. By James P. C. Southall. Clothbound, 426 pages, many diagrams. Published by Oxford University Press, 1937. Price $5.50.

The author's name at once stamps the book as first-class, for his recent "Mirrors, prisms and lenses" was a most authoritative treatise. The two works in fact supplement one another, and the earlier is frequently given as reference in the one under review.

The title suggests a simplified or superficial consideration of the subject. Most practicing ophthalmologists will find, however, that much of the material has been dealt with deeply; this may possibly be disappointing to the clinician who is not prepared for, nor interested in, mathematics. For instance, the chapters on ocular movements deal first with rotation of the globe within the orbit according to geometric lines and laws. Binocular vision is considered from the standpoint of projection, stereopsis, overlapping fields, and so forth. Therefore, if one were looking for clinical information on "muscles" and orthoptics it would not be found. This is not mentioned in criticism of the book but to point out to the clinicians the significance of the title.

One objection of the reviewer has to do with the make-up. Smaller type is given to matters of lesser importance, the idea supposedly being that in such form

of printing the reader may more readily select what is most important and what may be safely disregarded. The reviewer is always tempted to include the material in fine print and because the print is fine the reading is unduly difficult. Otherwise the format is excellent.

The author has done much to keep alive what might be a dull subject by including numerous historical notes. The book is thoroughly reliable and should be welcomed by those interested in this subject.

H. Rommel Hildreth.

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ELEMENTI DI BIOMICROSCOPIA OCULARE. By G. Sala. 206 pages, 88 figures. Bologna, Licinio Cappelli Ed.

This is the first manual of biomicroscopy of the eye for the use of the practicing ophthalmologist to appear in the Italian language. The book is divided into two parts: part one gives a detailed description of the Zeiss slitlamp and enters into a discussion of the principles of the biomicroscopic examination. The technique of the examination with the aid of the various illuminations is well described and much useful information is given for the interpretation of the findings.

The second part deals with the various structures of the eye, and the chapters are divided according to anatomic precedence antero-posteriorly, from conjunctiva to vitreous. Gonioscopy is briefly mentioned.

The author has expressed himself clearly and simply so that the book is adapted to beginners. The wealth of illustrations, some of which were made by the author, serves to give in schematic form a clear idea of the progress made with this objective examination of the eye.

There is a large bibliography of some 400 references, from Italian and foreign writers, together with an index.

The book will be a great help in making the use of the slitlamp popular; it deserves to be on the bookshelf of every practicing ophthalmologist for prompt consultation.

V. La Rocca.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

## 1

## GENERAL METHODS OF DIAGNOSIS

Balcet, Carlo. **Sero-diagnosis of syphilis in ophthalmology.** Boll. d'Ocul., 1937, v. 16, July, pp. 758-767.

A comparative study of the Wassermann, Kahn, and other tests was made in about one thousand patients affected by syphilis of ocular structures. Reactions were obtained in patients affected by congenital or acquired syphilis, and even in patients under treatment. The later tests are to be preferred to the Wassermann, because they are simpler and more reliable. (Bibliography.)

M. Lombardo.

Hildreth, H. R. **Method of preparing a transparent eyeball.** Amer. Jour. Ophth., 1937, v. 20, Dec., pp. 1249-1250.

Hubert, Louis. **Diagnostic significance of epinephrine instilled into conjunctival sacs.** Arch. of Ophth., 1937, v. 17, June, pp. 1076-1084.

The sympathetic nerve supply of the eye is discussed and illustrated by a drawing. Six cases are reported to show the effect of epinephrine in various conditions. Since smooth muscles become sensitive to epinephrine when denervated, it is possible to tell whether the lesion is in the superior cervical ganglion and its postganglionic fibers or in the preganglionic fibers and the central nervous system. In the first instance denervation of the smooth muscles of the eye results in hypersensitiveness to epinephrine, while in the second instance no denervation and no hypersensitiveness follow. Epinephrine hydrochloride (1 to 1000) instilled into the conjunctiva will stimulate the sympathetic vasoconstrictor nerves of the eye, but not the sympathetic fibers of the dilator muscle of the pupil in a normal person. In order to produce mydriasis by epinephrine the sympathetic nervous system of the eye must be in a state of hyperirritability. This irritability can be brought about by exophthalmic goiter, diabetes, certain drugs such as cocaine, irritation of the sympathetic fibers from acute otitis media or new growth, destruction of the superior cervical ganglion as occurs in chronic diseases of the middle ear and in some cases of Horner's syndrome, glaucoma, and pre-glaucomatous states.

J. Hewitt Judd.

Serr, H. **The monochromatic light of the sodium-vapor lamp as the light source for ophthalmoscopic examination.** Graefe's Arch., 1937, v. 137, pt. 4, p. 636.

Ophthalmoscopic examination with the monochromatic light from the sodium vapor lamp forms a valuable addition to present methods. In the presence of opacities of the media, it is frequently possible with this light to tell definitely about the fundus, where with the use of other sources of light the observer may fail. Details of the choroid (vessels and hemorrhages) not generally accessible are easily visible with this light. In detachment of the retina, immediate and certain differentiation between retinal tears and fresh retinal hemorrhages is obtained.

H. D. Lamb.

Trantas, A. **Exploration of the cornea by the diaphanoscope.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Oct., p. 881.

Diaphanoscopy, which was emphasized by Terrien (see Amer. Jour. Ophth., 1937, v. 20, p. 1287), has been used by the author for some years; and he discusses at length many lesions and ocular disturbances which are visible by this method. It is particularly valuable in studying conditions at the limbus and angle. Derrick Vail.

Van Lint. **Fragility of the capillaries in ocular tuberculosis.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Aug., p. 691.

The fragility of the capillaries is increased in ocular tuberculosis. This can be determined by cupping applied to the skin or by the tourniquet test. Göthlin and Hess have studied the fragility of the capillaries in a variety of diseases. The author applied the principles of the test to cases suspected of ocular tuberculosis. The patient's forearm is investigated to see if there are any petechial hemorrhages, and if there are they are marked off with India ink, to be disregarded after the test is finished. A tourniquet is then applied and a pressure of 35 mm. of mercury is maintained for fifteen minutes. It is then increased to 50 mm. of mercury for fifteen minutes and for a final fifteen minutes to 65 mm. of mercury. The arm is then allowed to remain free for about five minutes, which is the necessary time for disappearance of the edema. The petechial hemorrhages are counted. It is considered that the normal individual will have at least ten; fifty or more is pathologic. The enormous number found in tuberculous patients is very striking.

The author set himself two questions to solve. (1) Is the fragility of the capillaries increased in ocular diseases where hemorrhages constitute an important symptom? The answer to this question is negative. (2) Is this fragility increased in ocular tuberculosis as it is in pulmonary tuberculosis? The answer to this question is negative and positive, in the sense that taken with other methods of examination the evidence obtained from the fragility test might be of value. The author concludes that vitamin C and calcium are valuable adjuncts in treatment of ocular tuberculosis. (Bibliography.)

Derrick Vail.

## 2

## THERAPEUTICS AND OPERATIONS

Collenza, Domenico. **Diabetes and ocular surgery.** Boll. d'Ocul., 1937, v. 16, July, pp. 657-729.

After a general review the writer gives the results in his own 79 cases of cataract extractions, nineteen of glau-

coma operated upon by different methods, four of iridocyclitis with hypertension, and two of retinal detachment operated upon by the Gonin method. He concludes that glycemia, renal condition, and general blood pressure ought to be improved before operation. Insulin therapy facilitates the cicatrization of operative wounds. Operation is contraindicated in the presence of marked acidosis and diabetic cachexia. (Bibliography.) M. Lombardo.

Fiore, Tito. **Insulin therapy in diabetic and nondiabetic diseases of the eye.** Boll. d'Ocul., 1937, v. 16, April, pp. 366-399.

This study was made at the eye department of the University of Naples. The amount of glycemia in nondiabetic patients does not show any change after major eye operations (such as cataract extraction). There is thus no indication for preoperative use of insulin in eye surgery as proposed in general surgery in order to control postoperative hyperglycemia. In normal patients with poor general condition, however, the insulin may be used before the operation for its eutrophic action in stimulating systemic cellular activity. Insulin therapy must be used if an operation has to be performed in a diabetic, to the limit of obtaining disappearance of glycosuria and ketonuria and lowering of glycemia to near the normal. Insulin therapy is a useful adjunct to medical treatment of ocular diseases connected with diabetes, such as iritis, retrobulbar neuritis, and muscular paralysis. In primary glaucoma of diabetics the effect of insulin on intraocular pressure varies, and it has no appreciable influence on medical treatment of the glaucoma. Used generally, or even locally as a salve, insulin has a favorable effect in the recovery of ulcers or traumatic lesions of the cornea, even in nondiabetic patients affected by eye diseases related to constitutional affections, such as phlyctenular keratitis or even trachomatous pannus. (Bibliography.) M. Lombardo.

Friede, Reinhard. **Filling the conjunctival sac with ointment.** Zeit. f. Augenh., 1937, v. 93, Sept., p. 49.

For greater and more prolonged effect, the author recommends filling the entire conjunctival sac with a therapeutic ointment introduced by means of a 2 c.c. all glass syringe and a long canula. It is advisable to have the patient lie down and to keep the eye bandaged for a time after treatment. The large quantity introduced distends the sac and brings about contact of the ointment with ordinarily inaccessible portions of the conjunctiva.

F. Herbert Haessler.

Galbis Rubio, R. **Data in regard to eye drops.** Rev. Cubana de Oto-Neuro-Oft., 1937, v. 6, March-June, p. 44.

Care in the preparation of eye-drops, in regard to sterility, isotonicity, and PH, is advocated. M. Davidson.

Hofe, K. vom. **Experiences with some homeopathic remedies in eye patients.** Klin. M. f. Augenh., 1937, v. 99, Sept., p. 289.

The use of staphysagria tablets three times a day, recommended by Stauffer as a specific and prophylactic in persistent relapses of hordeolum, failed in eight out of ten cases. It is not specific and has no visible effect. Graphite improved four out of twenty cases of ciliary blepharitis and is worth trying. Tablets of calcaria carbonica three times a day given to twins of one and a half years suffering from scrofulous ophthalmia and eczema led to marked

improvement in the stronger one after a week, but none in the weaker. In dispensary children with phlyctenular infiltrations of the cornea the facial eczema dried up in a week and disappeared. C. Zimmermann.

Lordan, J. P., and Stimson, R. L. **A method of motion-picture photography of ocular surgery.** Amer. Jour. Ophth., 1937, v. 20, Nov., pp. 1145-1146.

Motolese, Francesco. **Contribution to the study of epibulbar tuberculoma and to specific therapy in tuberculous affections of the eye.** Boll. d'Ocul., 1937, v. 16, May, pp. 483-499.

A woman of fifty years showed a whitish neoplastic mass, soft and slightly painful, adherent to the sclera at the temporal side of the right eye. Its surface was uneven. The intradermal tuberculin test gave a positive result. The excised mass revealed a microscopic structure typical of tuberculoma. A relapse of the epibulbar neoformation recovered under specific therapy (Dostol's tebesin). The case report is supplemented by report of three cases of tuberculosis of other eye structures, also successfully treated with tebesin. (Bibliography, 3 figures.)
M. Lombardo.

Musial, A., and Lauterstein, M. **Tuberculin therapy of ocular tuberculosis.** Klinika Oczna, 1937, v. 15, pt. 4, p. 405.

This is a tabulated analysis of four hundred cases treated with tuberculin, relative to sex, age, occupation, religion, tuberculin reaction, tissue involved, and therapeutic result. The tables show the greatest incidence of tuberculosis in men, in the agricultural population, among Greek Catholics, and between twenty and fifty years of age. The most frequent diseases were keratoconjunctivitis, iridocyclitis, and chorioretinitis. The results were better in cases treated with old tuberculin than in those treated with tebeprotein. In tuberculosis of the conjunctiva, retinal detachment, vitreous opacities, and purulent dacryocystitis the results were negative or indefinite. Of the 400 cases 220 are tabulated as cured, 155 as improved, and 25 as unimproved.
Ray K. Daily.

Myerson, A., and Thau, W. **Human autonomic pharmacology. 9. Effect of cholinergic and adrenergic drugs on the eye.** Arch. of Ophth., 1937, v. 18, July, pp. 78-90.

Studies were conducted to determine the chemical reactions of mecholyl, prostigmin, atropine and benzedrine on the sympathetic and parasympathetic nerves. It is found that mecholyl, when instilled into the conjunctival sac, constricts the pupil to miosis but permits reaction of the pupil to light until extreme miosis has been reached. It increases accommodation and decreases intraocular tension. It narrows the palpebral fissure and probably dilates the blood vessels of the retina. Prostigmin has the same general effect when used alone, and is a synergist of mecholyl. Atropine prevents the action of mecholyl and abolishes its reactions when these are present. Benzedrine sulphate acts adrenergically on the eye. It dilates the pupil and diminishes the light reflex, increases intraocular tension, and diminishes the capacity of the lens for accommodation. It widens the palpebral fissure, narrows the arteries and veins of the retina, and reacts synergistically with atropine sulphate. A chart showing the effect of these drugs is included. J. Hewitt Judd.

Pfeiffer, R. L. **Hypersensitivity to pontocaine.** (Retinal detachment case) Arch. of Ophth., 1937, v. 18, July, pp. 62-64.

A man aged 28 years, with a retinal detachment in a highly myopic eye, developed severe conjunctival chemosis, corneal edema, and massive edema of eyelids, face, and the parotid region after instillation of two drops of a 0.5-percent solution of pontocaine. A patch test was positive after six hours. When on the tenth day the edema had subsided, it was noted that the retina had become reattached. It was still in place three months afterward. (Photographs.) J. Hewitt Judd.

Thompson, R., Isaacs, M. L., and Khorazo, D. **A laboratory study of some antiseptics with reference to ocular application.** Amer. Jour. Ophth., 1937, v. 20, Nov., pp. 1087-1098.

Weeks, J. E. **The amblyopia of arsenical therapy.** Trans. Western Ophth. Soc., 1936, 3rd mtg., pp. 154-165.

Amblyopia from use of pentavalent organic salts of arsenic occurs in a small percentage of cases. Vision may be permanently reduced to perception of light, but the greater number of patients recover useful, central vision. The fields of vision are permanently contracted concentrically to a greater or less degree, the amblyopia resembling that produced by quinine. As a rule, the amblyopia occurs after two to five injections have been given. The eyes of patients on this form of treatment should be examined from three to four days after each injection.

George N. Hosford.

Weeks, J. E. **Relation of the sympathetic nervous system to diseases of the eye, with regard to surgical procedures.** Arch. of Ophth., 1937, v. 17, June, pp. 967-982.

The physiology and anatomy of the sympathetic nervous system are briefly described. A review of the literature reveals that sympathectomy has not been successful in optic atrophy, exophthalmic goiter, or glaucoma. In retinitis pigmentosa, many reports are worthless because the operation has been incomplete. While sympathectomy is apparently of no value in advanced cases, the results so far reported indicate that an operation which cuts off all the fibers of the sympathetic nervous system that go to the eye may retard or arrest the progress of the disease in the early stage. After sympathectomy performed for the purpose of reducing systemic arterial hypertension, improvement in the ocular vascular condition has been noted. J. Hewitt Judd.

Yudkin, A. M., Orten, A. U., and Smith, A. H. **The production and cure of ocular disturbances in adult albino rats by adjustment of vitamin A.** Amer. Jour. Ophth., 1937, v. 20, Nov., pp. 1115-1118.

## 3

## PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Bender, M. B., and Alpert, S. **Abnormal ocular and pupillary movements following oculomotor paralysis.** Arch. of Ophth., 1937, v. 18, Sept., pp. 411-414.

A man aged 28 years, who had recovered from an oculomotor paralysis, showed abnormal movements of the upper eyelids, the internal rectus, and the pupil. All three abnormal movements occurred simultaneously and were in association with downward gaze. They resulted from faulty peripheral nerve regeneration and were

similar to those found after experimental section of the oculomotor nerves in monkeys. J. Hewitt Judd.

Blair, H. L. **Some new conceptions regarding egocentric visual localization.** Arch. of Ophth., 1937, v. 18, Sept., pp. 415-427.

In normal binocular visual localization the following fundamental correlations are present: (1) the correlation between fixation intent and simultaneous binocular foveal fixation; (2) the correlation between the positions of the foveal visual axes and the innervational status of the respective extraocular musculature; (3) the simultaneous, joint correlation between the positions of the two foveal visual axes and a single subjective localization in three dimensions; and (4) a further correlation between these subjective innervational representations and the size and thus the distance of seen objects. Retinal correspondence and ocular dominance are discussed. J. Hewitt Judd.

Bockoven, S., and Wilcox, B. **Significance of retinal fatigue in the study of general and nervous diseases.** Arch. of Ophth., 1937, v. 17, June, pp. 1024-1030.

The condition of the nervous system was studied by means of tests for retinal fatigability. In testing retinal fatigue for eyes with normal vision, it was found that for the average eye red caused fatigue most rapidly, then in order came yellow, blue, white and green. In abnormal eyes, those showing retinal arteriosclerosis tired most quickly. In ametropia, hyperopes fatigued more quickly than myopes, and myopes more quickly than emmetropes. Retinas of psychoneurotic patients became fatigued more quickly than those of average patients, and of these, the patients with neurasthenia showed marked fatigability. The retina becomes fatigued more quickly in malnutrition than in tuberculosis. Simple hypertension appears to lessen the retinal fatigability, arteriosclerosis to increase it.

J. Hewitt Judd.

Bothman, Louis. **Quick test for presence of a vertical prism produced by a decentered lens or crooked frame.** Arch. of Ophth., 1937, v. 17, June, pp. 1087-1088.

A Maddox rod, with a double loop of piano wire forming a clip, is hung over one lens of a pair of glasses to determine quickly whether a decentered lens or a crooked frame is producing a vertical prism. A second model which allowed the Maddox rod to be turned in various directions was discarded because it was too heavy. J. Hewitt Judd.

Carleton, E. H., and Madigan, L. F. **Relationships between aniseikonia and ametropia.** Arch. of Ophth., 1937, v. 18, Aug., pp. 237-247.

During the past six years 829 patients have been examined for aniseikonia. Of 625 given glasses for this condition, 500 are now wearing such a correction. Out of 425 reporting, 283 patients stated that definite relief from ocular and general symptoms had followed correction of their aniseikonia. For 103 no significant change had been made in the refraction. Hence it is concluded that the relief obtained was the result of correction of the aniseikonia. In 68 cases a significant change was made in the refraction, which leaves the result obtained equivocal. Significant amounts of aniseikonia were corrected in 14 cases of emmetropia and 74 with isometropia, showing that aniseikonia may exist independently of ametropia. However, since 195, or 69 percent of the patients

with aniseikonia were anisometropic, the presence of anisometropia suggests the possibility of concomitant aniseikonia. Although the correction of ametropia may be a partial cause of aniseikonia, there are many cases in which there is no relationship between the two or in which correction of the ametropia may tend to reduce rather than to increase the basic aniseikonia. The authors conclude that one important step in obtaining efficient binocular vision is the correction of aniseikonia; that an investigation for aniseikonia is indicated in all patients who have failed to obtain relief by correction of their refractive errors or motor anomalies; that the probable amount of aniseikonia cannot be arbitrarily deducted from the amount of ametropia present; and that all patients with anisometropia should be examined for aniseikonia, since anisometropia and aniseikonia are often concomitant. Five cases are reported in detail to illustrate various combinations. J. Hewitt Judd.

Clark, Brant. **A photographic analysis of alternating vision during reading.** Amer. Jour. Ophth., 1937, v. 20, Nov., pp. 1142-1144.

Obrig, T. E. **Fitting of contact lenses for persons with ametropia.** Arch. of Ophth., 1937, v. 17, June, pp. 1089-1120.

This review includes the history of the manufacture of contact glasses, a description of the ground and blown types, the correct method for fitting contact lenses, the making of casts and molded contact lenses, and the various indications for their use.

J. Hewitt Judd.

Ostwalt, F. **Still more on the "new theory" of anastigmatic spectacle lenses. An answer to the remarks of J. W. Nordenson.** (See Amer. Jour. Ophth., 1937, v. 20, Dec., p. 1274). Graefe's Arch., 1937, v. 137, pt. 4, p. 650.

The author cites various points of difference from Nordenson regarding spherical aberration of punctal spectacle lenses and the homocentricity and periscopic structure of the eye.

H. D. Lamb.

Prangen, A. D. **Some problems and procedures in refraction.** Arch. of Ophth., 1937, v. 18, Sept., pp. 432-447.

The author discusses some clinical aspects of refraction and his personal observation pertaining to the problems of technique and prescription. The discussion includes abnormal accommodating states according to the author's classifications, the use of cycloplegic, the use of the ophthalmometer, astigmatic dials, and the cross cylinder, the correction of anisometropia and antimetropia and a consideration of the effective power of lenses.

J. Hewitt Judd.

Schubert, G. **Intraocular mechanism for fusion.** Graefe's Arch., 1937, v. 137, pt. 4, p. 506.

In addition to the extraocular there exists a hitherto unknown intraocular mechanism for fusion. By reason of the latter, reactions occur from effects in the smooth muscles of the iris and ciliary body. With the help of subjective stigmatoscopy as described by Gullstrand, it is possible to detect quantitatively the smallest dioptric error in focusing the eyes. If with symmetrical convergence a point of light at a distance of 25 cm. is looked at by the author, each of his eyes is focused for the narrowest cross section. In normal eyes the latter falls with clear vision on the retina. This dioptric optimal focusing of each eye occurs

through rapidly alternating changes in the size of the pupil. Now if with fixation of the right eye the left eye is covered and then permitted for a time to be free after uncovering it (through drawing away of a screen or opening of an instantaneously closed diaphragm), the left eye before fusion will be found to be hyperopic. If on the other hand, with fixation and sharp accommodation of the left eye, the right eye is first covered and then allowed to be free, before fusion it is found to be myopic. Only after complete fusion are both eyes again dioptrically focused perfectly. H. D. Lamb.

Strebel, J. **Myopia and calcium metabolism.** Klin. M. f. Augenh., 1937, v. 99, Sept., p. 325.

In a former article Strebel showed that the sclera of the human eye with normal vision contained three percent calcium. To prove that calcium metabolism has something to do with myopia four cases are described, in which myopia developed after the twenty-fifth year, with coincident disturbances of the whole calcium metabolism such as often occur during pregnancy, especially manifested in deficiency of the teeth. The cases presented a parallelism between metabolic disturbances of the teeth and sclera (elongation of the eyeball and myopia). The problem of nutrition, and of calcium metabolism as a partial coëfficient in the myopia problem, is discussed in detail.

C. Zimmermann.

Weeks, J. E. **Progressive myopia.** Trans. Western Ophth. Soc., 1935, 2nd mtg., pp. 68-81.

The author gives an interesting summary of the literature of the subject and outlines the conventional treatment.

George N. Hosford.

## 4

## OCULAR MOVEMENTS

Cass, E. E. **Divergent strabismus.** Brit. Jour. Ophth., 1937, v. 21, Oct., pp. 538-559.

The most favorable cases for treatment are those of divergent excess. The author's extensive findings do not lend themselves to abstract. They are set forth under the following headings: historical, binocular vision in cases of convergence insufficiency, treatment, types of squint which respond to treatment, and operations. It is stressed that patients must learn to coöperate by directing their attention to the use of the two eyes together through all their waking moments. (Tables.)

D. F. Harbridge.

Dickey, C. A. **Some unusual cases of squint.** Trans. Western Ophth. Soc., 1936, 3rd mtg., pp. 139-145.

In the opinion of the author, if the patient has good fusion, or if there is a possibility of developing single binocular vision, vertical deviation should be corrected first, and if lateral deviations remain they should be corrected at subsequent operations. If only a cosmetic result is desired, then correction of the lateral defect first is preferable. Six illustrative cases are presented in detail. George N. Hosford.

Doyne, P. G. **Some cases of paralytic squint.** Brit. Jour. Ophth., 1937, v. 21, Oct., pp. 531-534.

The author presents eight follow-up cases of congenital or early infantile paralytic squint, based on synoptophore findings, and using mostly cases from the age of eight years upward in order that the paralysis would have been present for some time. The cases are presented for points of interest and not for conclusions. D. F. Harbridge.

Green, John. **A new caliper.** Arch. of Ophth., 1937, v. 18, Sept., pp. 430-431. Also Sec. on Ophth., Amer. Med. Assoc., 1937, 88th session.

A caliper for marking on the sclera the desired position for the new insertion of the rectus muscle is described. One shank carries a thin shaft of steel with a very fine, sharp point, guarded by a shoulder which prevents penetration of the sclera. The other carries a small, round-end knife which can be removed for sharpening if necessary. The instrument is well shown by a drawing. J. Hewitt Judd.

Lancaster, W. B. **Physiology of disturbances of ocular motility.** Arch. of Ophth., 1937, v. 17, June, pp. 983-993.

The anatomy and physiology of the extraocular muscles are reviewed to show that the prevalent idea that most cases of heterophoria are due to weakness of one or more of the muscles is erroneous. Each muscle is so strong that only one fiftieth to one hundredth of the fibers would need to act at one time. By shifting the load from one set of fibers to another, the first set would have sufficient time to recover from fatigue before their turn came again, and thus prolonged activity would be maintained without fatigue. The chief value of orthoptic training lies in its effect on the activity of the supranuclear centers, not on the strengthening of the muscles themselves. It therefore depends on the capacity of the fusion faculty for educational development. The purpose of operation on the ocular muscles is to change the position of the eyeball in the orbit so that less adjustment is necessary on the part of the neuromuscular mechanism or fusion faculty; and not to weaken or strengthen a muscle. In muscle operations the contact arc, which is usually from 7 to 9 mm. long, should not be reduced to less than 3 mm. In discussing binocular movements, the author points out that the innervation to the two eyes is always equally divided between them and that the mechanism by which the two eyes are made to work together as a binoculus is the fusion faculty. The neuromuscular mechanism underlying binocular movements is discussed, especially as to amplitude or range of fusion, amplitude of divergence, prism and accommodation convergence, the fusion-free position or so-called position of rest, and muscle tonus. J. Hewitt Judd.

McFarland, R. A., Knehr, C. A., and Berens, C. **The effects of anoxemia on ocular movements while reading.** Amer. Jour. Ophth., 1937, v. 20, Dec., pp. 1204-1219.

O'Connor, Roderic. **The recession operation—a criticism.** Trans. Western Ophth. Soc., 1935, 2nd mtg., pp. 40-44. (See Amer. Jour. Ophth., 1935, v. 18, Dec., p. 1137.)

Voisin, Jean. **Paradoxic elevation of the upper lid on looking down.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Oct., p. 896.

In 1893 Fuchs drew attention to the fact that occasionally, following paralysis of the third nerve with ptosis, there develops the phenomenon of paradoxic ascent of the closed eyelid on looking downward. This is not merely an immobility of the upper lid, as in Graefe's sign, but is a distinct retraction of the upper lid. There are two theories, first the nuclear and second "derailment" (regeneration of a nerve into the wrong muscle group). The author substitutes a third, namely, an abnormal synergism between the elevator of the upper lid and the muscles which are associated in turning the eyeball down.

Derrick Vail.

## 5

## CONJUNCTIVA

Allen, J. H. **Staphylococcic conjunctivitis.** Amer. Jour. Ophth., 1937, v. 20, Oct., pp. 1025-1030.

Arguello, D. M. **Prevention of blindness among the new-born in the Province of Buenos Aires.** Arch. de Oft. de Buenos Aires, 1937, v. 12, June, p. 343; also Rev. Oto Neuro-Oft., 1937, v. 12, July, p. 175.

Because of absence of federal regulation for prevention of ophthalmia neonatorum, progress has been slow. Various measures are advocated to make registration more effective, among them that of distributing, at marriage as well as on the occasion of birth registration, information on prophylaxis. M. Davidson.

Bellows, J. G. **Effect of cysteine hydrochloride on the conjunctiva.** Arch. of Ophth., 1937, v. 18, July, pp. 76-77.

This drug dusted into the conjunctiva caused an increase in the epithelial layer of the conjunctiva of a rabbit from three or four layers to five or six layers after three weeks, and to from nine to twelve layers after six weeks of treatment. Since thick mucous membranes are very resistant to the gonococcus, it is suggested that this treatment should prove of value in treating gonorrheal ophthalmia. In cases in which the condition is unilateral this application to the uninvolved conjunctiva may be a means of prophylaxis.

J. Hewitt Judd.

Brecher, I. **Effectual treatment of ophthalmic blennorrhea by steam-spray hyperthermy.** Klin. M. f. Augenh., 1937, v. 99, Sept., p. 301.

At a distance of 10 or 12 cm. from the eye a constant temperature maximum of 42°C. is maintained. It is perfectly harmless for the ocular tissues and suffices for rapid killing of the gonococci or total loss of their virulence. The author obtained very speedy arrest of purulent secretion in five cases of gonorrheal conjunctivitis in adults and thirteen cases of blennorrhea neonatorum. The treatment also relieved pain, especially when there were affections of the cornea. Simultaneous application of argolavalan salve was helpful.

C. Zimmermann.

Cassuto, N. **The conjunctival affections caused by bipolar bacilli.** Zeit. f. Augenh., 1937, v. 93, Sept., p. 57. (See Amer. Jour. Ophth., 1937, v. 20, Aug., p. 861.)

Cuénod, A., and Nataf, R. **Experimental researches on trachoma contagion.** Rev. Internat. du Trachome, 1937, v. 14, April, p. 104.

A review of the literature and record of experimental transfer of trachoma from man to lice and from lice to the monkey. Human conjunctival secretions infected with trachoma are inoculated into the intestines of lice. After a few days there is a veritable culture of rickettsias in the intestines of the louse. Material from the infected louse intestine is inoculated into the conjunctiva of monkeys, a certain percentage of which develop clinical trachoma and show rickettsias. The authors believe they have proved that trachoma is a "rickettsiosis" and that the louse is a reservoir for the virus.

J. Wesley McKinney.

Cuénod, A., and Nataf. R. **Research on the etiology and pathology of trachoma.** Rev. Internat. du Trachome, 1937, v. 14, April, p. 117. (See Amer. Jour. Ophth., 1937, v. 20, Dec., p. 1277.)

Derkač, V. **Antimony in trachoma.** Klin. M. f. Augenh., 1937, v. 99, Sept., p. 311.

Since May, 1936, Derkač has treated fifty trachoma patients with intravenous injections of freshly prepared one-percent sterile solution of antimony tartrate, in doses of from 2 to 3 c.c. every second day, and in series of ten doses with intermissions of from ten to fourteen days. The most striking result was the very rapid, sometimes sudden, disappearance of pannus and of corneal ulcers. Ptosis and blepharospasm were favorably influenced. In one case, unusually large granules disappeared. In one case slow subsidence of plasmoma, and of argyrosis of twenty years standing, was observed after three injections. A complicating infection with the Morax-Axenfeld diplobacillus was very favorably influenced. All patients received the usual treatment beside the injections. Blue stone especially proved very effective. The author is tempted to declare the action of antimony in trachoma as specific, but reserves the question for further investigation.

C. Zimmermann.

Fonseca, Aureliano. **Nondiphtheric membranous conjunctivitis.** Soc. de Opht. de São Paulo, 1937, Oct. 14. From manuscript sent by author.

The author's case finally appeared to be due to Koch-Weeks bacillus. He suggests that a diagnosis of diphtheric conjunctivitis should not be accepted until after inoculation into guinea pigs. The initial laboratory test should not be limited to the presence of the diphtheria bacillus but should include investigation for a number of other organisms, followed by cultures and animal inoculation.

W. H. Crisp.

Gifford, S. R. **The question of the syndrome described as Parinaud's conjunctivitis.** Zeit. f. Augenh., 1937, v. 93, Sept., p. 52.

Gifford discusses the propriety of identifying Parinaud's disease with oculo-glandular conjunctivitis as Pillat has done (see below). Both oculoglandular tularemia, first described in America, and the leptothricosis known in America as Parinaud's conjunctivitis are very much more common here than in Europe. One of the most important clinical differences is in severity of general manifestations. Always tularemia is very severe, in a few cases even lethal. Parinaud's conjunctivitis is limited to from three to five days of malaise and fever. In tularemia agglutination of cultures is positive after the second week. Tularemia is acquired only by contact with rodents. In Parinaud's conjunctivitis leptothrix is usually demonstrable. In America, there is no question that the two diseases are separate entities. Gifford feels the rules of nomenclature will be best served if the name Parinaud's conjunctivitis is reserved for the affection which most nearly resembles Parinaud's original description, namely leptothricosis. In any event, tuberculosis of the conjunctiva should not be included.

F. Herbert Haessler.

Kapuscinski, W. J., Jr. **Ocular pemphigus,** Ann. d'Ocul., 1937, v. 174, July, pp. 451-473.

Four cases of ocular pemphigus are described in great detail. Slitlamp and histologic studies were made. One case was considerably improved by corneal transplantation. The author concludes that ocular pemphigus is characterized by a primary degeneration of the conjunctiva, especially the epithelium. The pathologic process in the cornea involves only the superficial layers of ectodermal origin and is perhaps com-

parable to the conjunctival change. The chronic inflammation characterized by cellular infiltration is due to secondary microbic invasion of tissues already altered by pemphigus degeneration.

John C. Long.

Lijo Pavia, J., and Tartari, R. A. **Trachoma concerning epithelial inclusions.** Rev. Oto-Neuro-Oft., 1937, v. 12, June, p. 161.

For study of epithelial inclusions the authors recommend Busacca's method of staining with Victoria blue applied immediately to smears made from a fragment of excised conjunctiva.

M. Davidson.

Meloni, Vittorio. **Pathology and newer treatment of trachoma.** Rassegna Ital. d'Ottal., 1937, v. 6, May-June, p. 326.

An adeno-lymphatic status was present in greater or lesser degree in the patients. The idea that infection is superadded finds support in the microscopic, the clinical, and the bacteriological pictures, as well as therapeutically. Two microörganisms are prominent, one Proteus, which produces the edematous type of inflammation, and the other, probably B. granulosis, which causes ulceration and destruction. The earlier stage of B. granulosis is much more effective than the older form whose virus is attenuated. The marked tendency to acidosis present in the trachomatous patient is believed to be a constitutional state favoring development of the disease. "Lacmin," a vaccine made by Ruata, was found helpful in clearing up the conjunctival infection. "Endoneutralos," a mixture of citrates of sodium and potassium described by Scala, overcame the acidosis and was helpful in general building-up. (13 figures, 1 colored plate.)

Eugene M. Blake.

Pillat, A. **Reply to Gifford's article** (see above) **on Parinaud's conjunctivitis.** Zeit. f. Augenh., 1937, v. 93, Sept., p. 55.

Pillat thinks that the name Parinaud's conjunctivitis is purely a clinical one for an infectious disease of the conjunctiva with follicles and involvement of the regional lymph nodes. It can be caused by leptothrix, bacillus pseudotuberculosis rodentium, bacillus tuberculosis typus bovinus, and bacterium tularense. Possibly others will still be discovered. Whenever possible this clinical diagnosis should be replaced by an etiological one.

F. Herbert Haessler.

Queiroz, S., and Sales, M. **Plasmoma of the conjunctiva.** Arquivos do Inst. Penido Burnier (Brazil), 1937, v. 4, June, pp. 345-348.

The patient was a man of 27 years with second-stage trachoma, and pannus manifest to the corneal microscope. The upper and lower culs-de-sac were filled with tumor masses. Curettage and application of silver nitrate were unsuccessful, so that surgical removal was resorted to. (Photomicrograph, references.)

W. H. Crisp.

Sédan, Jean. **Trachoma contagion from the clinical point of view.** Rev. Internat. du Trachome, 1937, v. 14, April, p. 65.

This is an exhaustive review of the literature of the subject.

Thygeson, Phillips. **Bacterial factors in chronic catarrhal conjunctivitis.** 1. Role of toxin-forming staphylococci. Arch. of Ophth., 1937, v. 18, Sept., pp. 373-387.

The author reports experiments which indicate that toxin-producing strains of staphylococcus aureus and

albus are pathogenic for the conjunctiva and are a frequent cause of chronic catarrhal conjunctivitis. The staphylococci multiply in the conjunctival secretion or on dead cells and do not invade the conjunctival epithelium; conjunctivitis being caused by liberation of a toxin. Some of the characteristics of this toxin are recorded. Although it is usually produced simultaneously with a hemolytic toxin, it may be distinct from it. The coagulation test was found to give the highest correlation for estimating toxicity of staphylococci. No evidence was obtained that allergy to staphylococcus toxin played any part. J. Hewitt Judd.

Trantas, A. **Some clinical questions concerning trachoma.** Rev. Internat. du Trachome, 1937, v. 14, April, p. 131.

This is an enumeration and discussion of a large number of clinical phases, complications, and conditions associated with trachoma.

J. Wesley McKinney.

Whiting, M. H. **Conjunctival pemphigus.** Brit. Jour. Ophth., 1937, v. 21, Oct., pp. 529-531.

Directing attention to the full details of a previous article (see Ophth. Year Book, 1922, v. 18, p. 128), a résumé is given of the case in point. A contact lens filled with liquid paraffin instead of saline afforded better sight to the patient—first seen in 1916 after being treated for trachoma for many years. Creation of a lower fornix for the left eye with a mucous membrane graft from the lip is another interesting incident of the case. D. F. Harbridge.

Wright, R. E. **Isolation of Verhoeff's leptothrix in a case of Parinaud's syndrome.** Arch. of Ophth., 1937, v. 18, Aug., pp. 233-236.

The leptothrix was grown on Soparkar's medium of heated human blood agar, hydrocele agar, and ordinary agar enriched by a surface smear of fresh human blood from material obtained by aspiration from the center of the preauricular gland under sterile conditions. Growth was obtained in subcultures under both aërobic and anaërobic conditions. The growth was more luxuriant under anaërobic cultivation. The composition of the media used in these experiments is detailed.

J. Hewitt Judd.

## 6

### CORNEA AND SCLERA

Alamilla, Gustavo. **Congenital corneal opacities.** Rev. Cubana de Oto-Neuro-Oft., 1937, v. 6, March-June, p. 33.

An infant was born with milky white eyes and was subject to recurrences of ciliary injection and hypertension. The case improved under antiluetic treatment indicated by blood tests of child and mother. M. Davidson.

Barkan, H., and Borley, W. E. **Familial cornea plana, complicated with cataracta nigra and glaucoma.** Trans. Western Ophth. Soc., 1935, 2nd mtg., pp. 34-38. (See Amer. Jour. Ophth., 1936, v. 19, April, p. 307.)

Bloch, Fritz. **Embryotoxon corneae posterius Axenfeld.** Arch. of Ophth., 1937, v. 18, July, pp. 68-72.

The sixteen cases previously reported are divided into three groups; those in which there was a complete ring on the posterior surface of the cornea some distance from and parallel to the limbus, those in which there was a partial band and in which possibly the rest of the complete ring was invisible behind the limbus, and those in which there

was a broad band of tissue without free space between the limbus and the band, or a network formation on the back of the cornea. The case reported belongs in the second group. In each eye a slightly wavy, white, transparent band extended across the temporal peripheral region, apparently coming from and terminating in the angle of the anterior chamber. The band gave the impression of an empty blood vessel. The author suggests that this condition represents an atypically located branch of Schlemm's canal.

J. Hewitt Judd.

Federici, Ermanno. **A and D vitamins in corneal reparative processes.** Boll. d'Ocul., 1937, v. 10, April, pp. 357-365.

In several rabbits the writer removed a superficial disc of corneal tissue and instilled drops of common cod-liver oil in the conjunctival sac. Some irritation of the conjunctiva followed but the process of repair of the loss of tissue was more rapid and the scar tissue less visible than in the control eye. If refined neutral cod-liver oil was used in one eye and an oily vehicle containing the same amount of vitamins A and D in the control eye the results were equal, but far better than those obtained by use of xeroform, red oxide, and other salves. The author concludes that in daily practice, in view of the antibacterial action of cod-liver oil, its use in collyrium or as a 10-to-50 percent salve is to be preferred to other means. (Bibliography.) M. Lombardo.

Grancini, Enrico. **Metastatic annular abscess of cornea with acute course ... from hemolytic streptococcus.** Boll. d'Ocul., 1937, v. 16, July, pp. 742-757.

A man of 58 years became affected by a rapidly destructive infectious process in the cornea, which before its perforation showed a yellowish ringlike elevation about 2 mm. from the limbus and concentric with it. Blood culture showed a gram-positive streptococcus. With deterioration of the eye condition the patient's general conditions became worse, and he died about ten days after the beginning of the eye disease. The bacteriologic researches and the histologic examination of the eyeballs are described. The author concludes that the corneal lesion was secondary to cryptogenetic septicemia from a hemolytic streptococcus. (Bibliography, 8 figures.) M. Lombardo.

Graves, Basil. **Bilateral mesial superficial deficiency of the sclera.** Brit. Jour. Ophth., 1937, v. 21, Oct., pp. 534-538.

In this article, the author responds to a request for details of the eye condition indicated, mention of it having been made in "The eye and its diseases" edited by Berens and published in 1936. It is suggested that the full title of this discussion might well be "Developmental bilateral mesial superficial intagliated deficiency of the sclera." In all the author has observed and briefly cites seven cases of this defect of the sclera. (4 figures.)

D. F. Harbridge.

Grolman, G. von. **Traumatic heredoluetic interstitial keratitis.** Arch. de Oft de Buenos Aires, 1937, v. 12, July, p. 449.

The author's case supports the conclusions reached by many writers that apart from the presence of spirochetosis, additional determining causes, among them accidental or surgical trauma, are essential to explain the appearance and evolution of heredoluetic keratitis. Following a contusion of the young man's right eye with a rubber tube, with hyphemia and imbibition of

blood by the cornea, a faint deep vascularization persisted for two months and a half. About three months after the accident to the right eye, the left eye presented a typical interstitial keratitis, and the blood Wassermann was found to be four plus. M. Davidson.

Hilgartner, H. L., Hilgartner, H. L., Jr., and Gilbert, J. T. **A preliminary report of a case of keratoconus, successfully treated with organotherapy, radium, and short-wave diathermy.** Amer. Jour. Ophth., 1937, v. 20, Oct., pp. 1032-1038.

MacMillan, J. A., and Cone, W. **Prevention and treatment of keratitis neuroparalytica by closure of the lacrimal canaliculi; report of a case.** Arch. of Ophth., 1937, v. 18, Sept., pp. 352-355.

The authors feel that the primary etiologic factor causing the corneal lesions is the diminished secretion of tears. In this case occlusion of the canaliculi, to help prevent drying of the cornea, resulted in prompt healing of the corneal lesion. J. Hewitt Judd.

Malbran, J. **Fuchs's epithelial dystrophy and capsular glaucoma.** Arch. de Oft. de Buenos Aires, 1937, v. 12, July, p. 441.

A male aged 73 years presented simultaneously a Fuchs's epithelial dystrophy in the left eye and exfoliation of the lens capsule in the right eye, without hypertension in either eye. The author believes the two conditions to represent a senile degenerative process, the glaucoma observed in connection with them being secondary. (Illustrated.) M. Davidson.

Marucci, Luigi. **Bullous keratitis and epithelial dystrophy of the cornea secondary to cataract extraction.** Boll. d'Ocul., 1937, v. 16, June, pp. 625-636.

A man of 46 years after bilateral cataract extraction became affected by recurrent attacks of thin, diffuse turbidity of both corneae with formation of transparent bullae in the right cornea. In the discussion of the case the writer states that changes of the anterior limiting membrane were responsible for the lesion observed. A preëxisting nutritive condition of the cornea, due to the patient's work on furnaces, was a predisposing factor, and the surgical procedures the exciting factors. (Bibliography.) M. Lombardo.

Melanowski, W. H. **A new direction in the therapy of recurrent corneal ulcer.** Klinika Oczna, 1937, v. 15, pt. 4, p. 409.

A brief review is given of investigations, including the author's own, on the bactericidal properties of tears, and on the qualitative and quantitative changes in lacrimal secretion associated with superficial corneal ulcers. This is followed by a detailed report of ten cases of recurrent corneal ulcers treated with a 5-percent extract of bovine lacrimal gland in a solution chemically identical with the tears. Instillation of the solution every two hours was rapidly followed by epithelization of the ulcers. The results were excellent in marginal, dendritic, and trachomatous ulcer but were negative in infected ulcer. Ray K. Daily.

Motegi, A. **Hematologic observations in parenchymatous keratitis due to congenital lues.** Graefe's Arch., 1937, v. 137, pt. 4, p. 527.

In 56 cases of parenchymatous keratitis from congenital lues, the condition of the blood was determined in the progressive, maximum, and convales-

cent stages. As controls, these blood findings were compared with those in 35 healthy individuals and 26 patients affected with some fifteen different types of corneal disease including tuberculous, traumatic, ulcerative and nonulcerative forms. This lengthy report of 82 pages studies the number and form of the erythrocytes; total number and differential count of the leucocytes and leucocyte index (ratio of number of lymphocytes to that of neutrophile leucocytes); specific weight of the blood; hemoglobin content and color index (average amount of hemoglobin in individual erythrocytes); number of blood platelets; resistance of the erythrocytes; sedimentation rate of the erythrocytes; viscosity of the blood and viscosity of the serum, content of albumen in the serum; comparative volume of blood cells and plasma; classification of neutrophile polymorphonuclear leucocytes by shape of nuclei and modification from taking food; differentiation of leucocytes according to size and modification from taking food; and the lymphocyte reaction or the effect of taking food upon percentage of lymphocytes.

Very striking in parenchymatous keratitis from congenital lues are diminution of eosinophilic leucocytes, low color index, increase in number of blood platelets, and rapid sedimentation of erythrocytes. From the findings in the blood in the early stages of this ocular condition, its outbreak can be predicted. H. D. Lamb.

Narog, Franciszek. **The treatment of pannus with electrocoagulation.** Klinika Oczna, 1937, v. 15, pt. 4, p. 489.

Instead of a peritomy the author did electrocoagulation of the blood vessels at the limbus, with very good results in eighteen out of twenty cases. The postoperative reaction lasts from one to two weeks, and recovery takes place in from three to four weeks. The author reports two cases of tuberculous keratoconjunctivitis diagnosed and treated as trachoma, and cautions against this error in diagnosis. Ray K. Daily.

Sala, Guido. **Relapsing and transitory opacity of corneal epithelium.** Boll. d'Ocul., 1937, v. 16, June, pp. 595-601.

A woman of 32 years affected by diabetes, who was examined by the writer for defective vision of the right eye, showed under the slitlamp a diffuse opacity of the anterior surface of the lower three quarters of the cornea of each eye. The picture was similar to the appearance of the corneal epithelium after cocaine has been instilled. It was transitory but frequently relapsed. It is the opinion of the writer that this lesion was due to poor resistance and special susceptibility of the epithelial cells of the cornea in the presence of an increased amount of glucose in the tears. (Bibliography, 2 figures.)

M. Lombardo.

Selinger, Elias. **Treatment of dendritic keratitis with quinine bisulphate.** Arch. of Ophth., 1937, v. 17, June, pp. 1085-1086.

In the past two years eleven adults with simple dendritic keratitis and one with herpes zoster of the cornea have been treated with an ophthalmic ointment containing two-percent quinine bisulphate applied to the conjunctival sac twice a day. In each case the subjective symptoms improved from the beginning and there was no extension of the corneal lesion. This form of therapy compares favorably with other more strenuous measures and is preferable because of its simplicity and lack of discomfort. J. Hewitt Judd.

Von der Heydt, Robert. **Osteitis deformans with pigmented corneal degeneration.** Amer. Jour. Ophth., 1937, v. 20, Nov., pp. 1139-1141.

Weekers, L. **Paroxysmal allergic edema of the eyeball. Its relationship to intermittent edema of the cornea.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Sept., p. 769.

After citing two cases of amblyopia associated with migraine following ingestion of foreign protein to which the patients were sensitive, the question of intermittent edema of the cornea, the pathogenesis of which is unknown at the present time, is undertaken. Weekers believes that this edema has an allergic foundation. Essentially, the lesion consists of angioneurotic edema of a part (iris, ciliary body, choroid) or the entire uveal tract. In many of these cases precipitates are discovered on the posterior surface of the cornea and they are frequently associated with edema of the corneal epithelium itself. In the benign form of the disease the ocular tension remains normal. Often one notices at the time of the ocular crisis many other lesions in the skin similar to those seen in the edema of Quincke (anesthesia of mouth or tongue, auditory disturbances, hemiplegia, or other nervous diseases implying a cerebral localization). The ocular manifestations are periodic and intermittent. They are produced in a paroxysmal fashion with exacerbation. Allergy is probably the chief factor. (Bibliography.)

Derrick Vail.

Wright, R. E. **Keratomalacia.** Trans. Western Ophth. Soc., 1936, 3rd mtg., pp. 106-115.

We rarely see pure vitamin-C deficiencies and we cannot draw sharp lines of demarcation between the clinical pictures because there is invariably overlapping of signs and symptoms. There is no reason why we should not have a multiple deficiency complex in any one case. The typical symptoms and signs of keratomalacia are outlined, both for children and for adults, where the picture is slightly different. Crude cod-liver-oil is recommended as the best treatment. In very miasmatic keratomalacic babies, application of cod liver oil in oily combination on flannel binders has been effective.

George N. Hosford.

## 7

### UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Adler, F. H., and Meyer, G. P. **Tuberculous lesions of the uveal tract.** Arch. of Ophth., 1937, v. 18, Aug., pp. 275-287.

This review of the literature includes consideration of experimental pathology, clinical aspects, the relationship of ocular tuberculosis to general tuberculosis, the Mantoux test, and the treatment of ocular tuberculosis.

J. Hewitt Judd.

Baratta, Orazio. **Congenital familial iris changes.** Boll. d'Ocul., 1937, v. 16, March, pp. 339-354.

A woman of 52 years showed some congenital anomalies of the pupils and irises, lenticular changes, and monocular hydrophthalmus. Her children showed similar changes. Discussing the pathogenesis of these affections the writer states that they have their origin in inflammatory phenomena during embryonic life. He bases his hypothesis on the fact that his patients showed either old or recent general affections of probably tuberculous origin. (Bibliography, 4 color figures.) M. Lombardo.

Bokker, A. **Are the clump cells in the uvea modified chromatophores and**

**consequently of mesodermal origin?** Graefe's Arch., 1937, v. 137, pt. 4, p. 611.

The clump cells in the uvea may be of mesodermal as well as of ectodermal origin. Constant-current tissue-culture has demonstrated that a diminution in the nutritional supply may induce change of chromatophores into clump cells. The nature of the pigment in the clump cells is not of decisive significance in the differentiation of the origin of these cells. H. D. Lamb.

Gürich, Hellmuth. **Congenital entropium uveae in enzygotic twins.** Klin. M. f. Augenh., 1937, v. 99, Sept., p. 345.

Both twins, born September 14, 1895, had been under treatment on account of a hemorrhagic diathesis, whose hereditary character could be proved. The right pupil of one brother exhibited an apronlike ectropium uveae and the stroma of the iris a brownish pigment spot. Both had hypermetropia but normal vision. According to modern views on heredity, enzygotic twins are carriers of the same hereditary mass. Discordant occurrence of stigmata would speak for external origin. The value of the present single observation as to the question of heredity of ectropium uveae is limited. (Illustrations.)

C. Zimmermann.

Liesch, Enzo. **Contribution to the knowledge of pupillary reactions in man.** Boll. d'Ocul., 1937, v. 16, June, pp. 602-616.

After injection of 1 c.c. of prostigmin in man the writer noted a transitory moderate miosis, anisocoria, hippus, and disappearance of a preëxisting anisocoria. These phenomena are, according to the writer, expressions of a peculiar excitability of the mesencephalic segment of the parasympathetic system, and the anisocoria an index of unequal excitability of the two sides of the same segment. The writer thinks that the drug which is nontoxic, and affects but slightly other segments of the nervous system, is to be preferred to drugs having amphotropic action and a maximal effect which excludes the study of the pupillary reactions. The drug may be used as a means of disclosing the functional state of the mesencephalic segment of the parasympathetic. M. Lombardo.

McKeown, H. S. **Essential progressive atrophy of the iris; report of a case.** Arch. of Ophth., 1937, v. 18, Sept., pp. 347-351.

The case reported is that of a young lady, aged 29 years, who had been under observation for four years. At the first examination one pupil was seen to be slightly elongated. It had progressively enlarged vertically and temporally, but the pressure had remained normal. Gonioscopic examination revealed anterior peripheral synechia. The changes in the appearance of the eye are shown by a colored plate. The findings in cases previously reported are discussed. J. Hewitt Judd.

## 8

## GLAUCOMA AND OCULAR TENSION

Barkan, Otto. **Recent advances in the surgery of chronic glaucoma.** Amer. Jour. Ophth., 1937, v. 20, Dec., pp. 1237-1245.

Brown, E. V. L. **Vision and central fields after glaucoma operation.** Amer. Jour. Ophth., 1937, v. 20, Dec., pp. 1250-1251.

Corbett, H. V., and Roaf, H. E. **The recognition of flashing colored lights by persons with normal and defective color vision.** Brit. Jour. Ophth., 1937, v. 21, Nov., pp. 592-596.

The determinations of the authors support those of Guttmann in 1907 and 1908, in that the person with faulty color vision is more sensitive than the normal person in respect of size of aperture, brilliancy of lights, and extent of exposure. The lantern constructed for this work is described. Methods of examination, results, and a discussion of types 1, 2, and 3 are included in the article. (References.)

D. F. Harbridge.

Duke-Elder, Stewart. **The dialyzation of the intraocular fluids.** Brit. Jour. Ophth., 1937, v. 21, Nov., pp. 577-584.

The hypothesis as to swelling of the vitreous gel being responsible for intraocular pressure in primary glaucoma must be discarded (see Amer. Jour. Ophth., 1936, v. 19, p. 1137). This dissertation deals mainly with the author's explanation of the contrary findings of Robertson (see Amer. Jour. Ophth., 1937, v. 20, p. 1166) that is, findings contrary to hypotheses previously advanced by the author. The findings of Robertson are mainly described as being based on insufficient premises. The author concludes that the aqueous humor is not a simple dialysate as he had originally hypothesized but that on the other hand there is no positive demonstration for the theory that the aqueous is a secretion of the ciliary epithelium. Further argument is out of order, the proper procedure being to delve for more accurate experimental data.

D. F. Harbridge.

Hagen, S. **Norwegian contribution to the diagnosis and treatment of glaucoma.** Brit. Jour. Ophth., 1937, v. 21, Nov., pp. 597-598.

It is stated that since glaucoma is comparatively frequent in Norway, ophthalmologists are quite generally interested in the subject. Hjalmar Schiötz, deceased in 1927, and Holth have both done exceptional work in this field. The tonometer, as introduced by Schiötz, is described as being invaluable in diagnosis and therapeutic estimate. The author describes the operative method used by Holth as the one favored by the clinic. Holth recommends the stop keratome.

D. F. Harbridge.

Salzmann, Maximilian. **Iridectomy ab externo: statistics and results.** Zeit. f. Augenh., 1937, v. 93, Sept., p. 1.

Salzmann analyzes in detail his experience in 163 iridectomies done according to a method recommended by him in the same journal several years ago. The sclera is incised from without. The iris prolapses and is excised without allowing any instrument to enter the anterior chamber. The operation is indicated for tumors and cysts of the iris, frank or threatened increase of intraocular tension, and foreign bodies entangled in the iris. The iris may fail to prolapse spontaneously on completion of the corneoscleral incision because the pressure behind is decreased, because the pupillary margin is fixed by posterior or anterior synechia, or because the incision traverses the site of a peripheral synechia. The iris failed to prolapse in one half of the eyes with anterior synechia after perforated serpent ulcer. A second occurrence that makes it impossible to keep instruments from entering the anterior chamber is incarceration of the pillars of a coloboma in the angles of the wound, although often these can be released by gentle massage through the conjunctival flap. Vitreous loss is rare. It occurred only twice with primary glaucoma and seven times with secondary glaucoma. Other complications such

as expulsive and intraretinal hemorrhages are not peculiar to this operation.

The healing of the wound was usually uneventful. Real bursting of the wound did not occur nor was there any infection. In the first week great variation in the depth of the chamber was noted. One hundred patients were observed long enough for discussion of end results. In eighty a firm scar resulted and twenty developed a filtration scar. Fifteen of these occurred in eyes with uncompensated primary glaucoma. Statistics as to final functional results are no more illuminating than when used in evaluating any other procedure for the treatment of glaucoma.

One of the dangers of classical iridectomy is the occurrence of traumatic cataract. In this series six lenses became cloudy. In two of these operations the operation could not be completed without introducing instruments into the anterior chamber, but in the other four the operation progressed satisfactorily. It must be assumed that the lens capsule can rupture "spontaneously." Posterior cortical opacities appear early in every traumatic cataract, even when the injury to the capsule is anterior. F. Herbert Haessler.

Weekers, L., and Fanchamps, J. **Late tension results obtained by incarceration of the iris in different forms of glaucoma.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., July, p. 584.

An analysis of the authors' cases, consisting of 22 chronic, 13 acute, and 14 complicated glaucomas, at the end of a year or more following the operation of incarceration of the iris, reveals that the results were uniformly good. This operation, practiced in different forms of glaucoma according to the indicated technique, is not only the least mutilating and easiest to execute, but also the most effective. The authors have decided that incarceration of the iris is the operation of choice in glaucoma. Derrick Vail.

## 9

### CRYSTALLINE LENS

Buxton, Robert. **The eye hospital at Shikarpur, India.** Brit. Jour. Ophth., 1937, v. 21, Nov., pp. 605-612.

Six to eight hundred patients are accommodated during the busiest season. The wards, types of cases, facilities, and amount of work done are all described in considerable detail. Cataract extractions averaged 32 per day, with as many as 750 out-patients cared for during one day. The author also presents the method used for cataract extraction, together with a criticism of the method. (References.) D. F. Harbridge.

Castelli, Adolfo. **Lacarrère's "electrodiaphakia."** Boll. d'Ocul., 1937, v. 16, May, pp. 465-462.

Lacarrère's method of intracapsular lens extraction (introducing into the lens through the regular corneal section the two terminals of an electrode connected with a high frequency current) was tested by the writer in isolated rabbit lenses, in human cataractous lenses, and in normal rabbit lenses in position; using a current of 120 to 130 ma. The writer comes to the following conclusions: The terminals of the electrode penetrate the lens with a slight force corresponding to the weight of from 0.5 to 1.5 gm. The adhesion is rather firm, necessitating a force of not less than 40 gm. to remove the electrode from the lens. The extraction in toto of normal lenses from rabbit eyes was sucfessful in fifty per cent of the experiments, the failures being due to weak consistency of the lenses. The writer is

of opinion that this new method, with improvements, will find a successful application in cataract surgery. (Bibliography, 3 figures.) M. Lombardo.

Ciotola, Guido. **Alpha-dinitrophenol cataract.** Boll. d'Ocul., 1937, v. 16, May, pp. 531-549.

In the first part of the article the writer gives the general notions on pharmacologic action of this product. In the second part he reports his clinical observations on the manifestations of cataract in patients who had used it. The third part gives the results of his experimental researches on rabbits, dogs, and rats as to the possibility of reproducing cataract in animals. These results were negative. The interpretation given by the writer to explain the different action of dinitrophenol in patients and animals is that the product has probably no elective action for the lenses of these animals. According to his experience it has not the same effect on their weight. (Bibliography.)

M. Lombardo.

Jackson, Edward. **Late results of extraction of cataract.** Arch. of Ophth., 1937, v. 18, Sept., pp. 363-370; also Trans. Sec. on Ophth., Amer. Med. Assoc., 1937, 88th session.

The ultimate result after a cataract operation cannot be judged in a large clinic, but can be more properly evaluated by studying the results in private patients who have been followed to the end of their life, or at least for many years after the operation. The author discusses his personal results and summarizes those of 49 cases in a table. He also outlines technique of operation. (Discussion.) J. Hewitt Judd.

Mantinband, Mieczyslaw. **The first thousand intracapsular extractions on the ophthalmologic service of the Czyst hospital.** Klinika Oczna, 1937, v. 15, pt. 4, p. 389.

The lens was extracted in the capsule in 60 percent of immature cataracts, and in 46.4 percent of mature cataracts. There was prolapse of the iris in 8.8 percent of intracapsular and in 3.5 percent of extracapsular extractions. Postoperative iritis and infection were four times as frequent in the extracapsular extractions. There was no decided difference in incidence of loss of vitreous, hemorrhage into the anterior chamber, retinal detachment, and glaucoma in the two types of lens extraction.

Ray K. Daily.

Moncreiff, W. F. **Some technical questions in cataract surgery.** Amer. Jour. Ophth., 1937, v. 20, Dec., pp. 1245-1248.

Nastri, Francesco. **Contribution to study of the genesis of naphthalin cataract.** Boll. d'Ocul., 1937, v. 16, May, pp. 504-530.

Tabulated results are given of experiments on rabbits to determine whether naphthalin cataract originates from dysfunction of the parathyroids, and whether this type of cataract is to be included in the class of the parathyreoprivic cataract. Histologic examination of the glands, however, gave a negative result; and administration of calcium and of parathyroid extract to these naphthalized animals did not prevent the formation of cataract. Even administration of ascorbic acid and cystin gave the same result, showing that diminution or disappearance from the aqueous and the lens of the latter elements (which have their importance in tissue respiration) is not fundamental in manifestation of this cataract. In its genesis, important factors are the changes that take place in permeability of the hemato-ophthalmic barrier after

the use of naphthalin, such changes lowering the vitality of the lens and manifesting themselves in an increase of albumen in the aqueous. (Bibliography.)

M. Lombardo.

Ohm, J. **Cataract extraction with a hook.** Zeit. f. Augenh., 1937, v. 93, Sept., p. 65.

Ohm advises preliminary iridectomy, local anesthesia by instillation and injection near the superior rectus, and evipan anesthesia as well as akinesia. If the eye is not easily accessible, he does not hesitate to do canthotomy. He uses no speculum but holds the lids with sutures. After a bridle suture, he makes an ample incision through the limbus and opens the capsule with forceps and cystotome. The next step is the innovation. He inserts the 1-mm. hook of the cystotome into the lens near its lower margin and, while holding the corneal wound wide open with the upper part of the cystotome, actually pulls the lens out of the eye without any supplementary pressure. Slight massage from without serves to replace the iris. If masses of cortex remain, he makes no effort to expel them because of the dangers of infection and vitreous loss, and their harmlessness.

F. Herbert Haessler.

Pagani, Mario. **Again about cataract extraction.** Boll. d'Ocul., 1937, v. 16, June, pp. 588-594.

The writer describes his technique for extraction of senile cataract. After passing a thread in the superior rectus muscle the two ends are anchored on the upper branch of the speculum. A Beer knife is used in order to avoid prolapse of the iris in front of the instrument. The lens is delivered by means of a hook the pointed end of which is introduced through the corneal incision laterally and reaches the upper meridian of the eye. The hook is pushed behind the iris, through the upper margin of the lens, and behind the posterior capsule until a point below its posterior pole is reached. The point of the hook is engaged in the lens here and the lens is removed from its place and out through the corneal incision.

M. Lombardo.

Salit, P. W. **Seasonal variations in the lipid content of the crystalline lens.** Arch. of Ophth., 1937, v. 18, Sept., pp. 403-410.

A total of 128 human lenses removed by the intracapsular method were analyzed for total lipid content over a period of fourteen consecutive months. The lipids of each lens were extracted separately, and their amounts were estimated gravimetrically by a sensitive chemical balance. By plotting the monthly averages of lipid both in terms of percentage and in terms of absolute amount, a characteristic four-phase curve was obtained, in which the two crests coincide with summer and winter and the two troughs coincide with spring and fall. When the results of two similar series for cholesterol and phospholipid content were plotted, it was found that a summation gave a curve which strikingly resembled that of the total lipid content; the level for the phospholipids being elevated during the summer, and that for cholesterol being elevated during the winter, and the low levels coinciding with the spring and autumn as in the curve for the total lipid content.

J. Hewitt Judd.

Vecchi, I. de. **Researches on the amino-acid content of cataractous human lens.** Boll. d'Ocul., 1937, v. 16, April, pp. 400-413.

Researches made on 46 lenses of which 33 were soft and on 24 taken from cadavers lead the writer to the following conclusions. The human cataractous lens constantly contains a greater amount of amino acid than normal lenses. The average percentage of amino acid contained in soft cataracts is greater than in normal lenses and that contained in hard cataracts is lower than that contained in soft cataracts, although above the average value in normal lenses. The apparently normal human lenses taken from traumatized eyes contain a greater amount of amino acid than the lenses taken from a cadaver shortly after death. This shows that in the lens of traumatized eyes there exist chemical changes due to metabolic modifications. (Bibliography.)

M. Lombardo.

Vito, Pietro. **The changes of lens epithelium in experimental cataracta parathyreopriva.** Boll. d'Ocul., 1937, v. 16, July, pp. 730-741.

In rabbits the writer studied changes in the lenticular epithelium after removal of the parathyroids. Four different types of lenticular opacity developed, and six types of changes in the epithelial cells. The author concludes that these changes are similar to those obtained in other experimental cataracts, and also to those observed in senile cataract. (Bibliography.)

M. Lombardo.

Weekers, Roger. **Lactic acid of the lens.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Aug., p. 707.

The author found that the lactic-acid content of the lens of the calf and ox was higher than the lactic-acid content of the aqueous humor. The concentration of lactic acid in the young lens is higher than that in the old lens. The two lenses of a pair of eyes contain the same quantity of lactic acid. When a lens is immersed in Ringer solution, lactic acid diffuses from the lens toward the solution and the lactic-acid content of the lens is lowered. Partial discussion of the capsule does not modify the speed of diffusion. Renewal of the Ringer solution increases the total quantity of lactic acid diffused. The lactic-acid content of the crystalline lens remains constant during the entire length of the experiment, and the diffusion increases if one adds glucose to the Ringer solution. Immersed in Ringer's solution renewed many times, and especially in Ringer's solution fortified with glucose, the lens manufactures lactic acid during the length of the experiment. Diffusion of lactic acid can proceed from Ringer's solution toward the lens if a sufficient quantity of lactic acid has been added to the Ringer's solution. (Bibliography.)

Derrick Vail.

Zamenhof, Adam. **A blepharostat and a lens expeller for cataract extraction.** Klinika Oczna, 1937, v. 15, pt. 4, p. 427.

The author prefers the Luer-Pley blepharostat, held and regulated by an assistant, who in threatened prolapse of the vitreous can lower ocular tension by raising the speculum, and in extracapsular extraction can raise tension by pressure on the eyeball. The lens expeller designed by the author is a 5-cm. probe attached to a handle.

Ray K. Daily.

## 10

### RETINA AND VITREOUS

Arruga, M. H. **Retinal detachment; its operative urgency; the injection of air; large disinsertions.** Bull. Soc. Franç. d'Opht., 1936, v. 49, pp. 288-303.

The majority of recent cases where the detachment is slight, with tears, require operation. The chances for success are augmented by a binocular bandage and rest in bed for several days, especially when the site of the tear is quite elevated. The binocular bandage and rest should be insisted on in the majority of cases, even more than surgical measures. Their effect is greater than that of stenopeic spectacles, for the eye turns up and ocular movements are avoided. It is necessary for the detached retina to come into contact with the choroid during the first days after operation. To accomplish this the author often injects air into the vitreous chamber after the operation. The globe is perforated 6 or 7 mm. from the limbus with a fine needle or diathermic cautery, and 2.5 or 3 c.c. of air is injected. This procedure is suitable when there is a large bulging of the retina and when the bulb is quite empty after escape of subretinal fluid. Contraindications are cases in which the detachment occurs above. In this instance the air would get between the choroid and the retina. When the detachment is lateral the patient is cautioned not to turn on to the side opposite the site of the tear, for the same reason.

Large disinsertions with retinal detachments occurring at the ora serrata are difficult to cure because the free border of the disinsertion retracts and becomes arcuate and has to be fixed to the choroid in its backward position. Further, a large communication exists between the vitreous and the subretinal space, making easy the entrance of vitreous humor. The patient should lie quietly after the operation, and on the side corresponding to the lesion. The author isolates the detached region by a barrage at a little distance, where the retina is not very much separated, and makes drainage wounds behind the barrage as far back as possible in the detached zone. Large disinsertions above are difficult to cure. Those in a lateral position have a better prognosis. Those below are easy to treat but if the hole is large a large part of the upper visual field must be sacrificed. Case reports are given.

Clarence W. Rainey.

Cosmettatos, G. F. **The operation for retinal detachment by thermopuncture and diathermic coagulation.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., July, p. 579.

A comparison between diathermic coagulation and thermopuncture (method of Gonin) shows statistics to be approximately the same as far as results are concerned. The total of cures in each method is about 75 percent. The thermopuncture operation is reserved for small detachments with a single hole or with several holes close together. The diathermic-coagulation operation is reserved for cases of peripheral disinsertion of those in which the tear is not visible. (Bibliography.)

Derrick Vail.

Duggan, J. N., and Chitnis, V. K. **Retinitis of pregnancy.** Brit. Jour. Ophth., 1937, v. 21, Nov., pp. 585-592.

The point of interest in the three cases reported is the widely differing eye grounds. Each case is fully described. All the patients were young Mohammedan women. None had experienced ocular disturbances during previous pregnancies. In each instance ocular symptoms were observed in the seventh month of pregnancy. In two patients labor was induced while in the third it was accidental. In two cases definite benefits resulted from termina-

tion of pregnancy, while the third was probably also benefited. The third case was peculiar in that it was unilateral. If pregnancy is terminated at the appearance of soft-edged, cotton-wool patches and retinal hemorrhages, damage to the vascular system may be avoided. The question arises whether the ophthalmologist should advise interruption of pregnancy, in view of the fact that improvement, if not restoration, of vision generally occurs in the end. (References.)

D. F. Harbridge.

François, M. J. **Senile exudative macular degeneration.** Bull. Soc. Franç. d'Opht., 1936, v. 49, pp. 226-261.

The author mentions various contributors to the literature, and adds histories of two patients studied by himself. The characteristic lesion is described as a large irregular rounded or triangular spot occupying the macular area, some two disc diameters wide, of yellowish color, with numerous pigmented masses of variable dimensions and density. The border of the lesion is indistinct. In the neighboring retina may be numerous verrucous hyaline excrescences of the lamina vitrea. Small hemorrhages and exudates may be present. The retinal vessels pass over the lesion. The vision is lowered. The author's cases showed vascular changes in the extremities. In one patient large hemorrhages in the macula were first observed. Administration of acetylcholine intramuscularly over five months did not change the ophthalmoscopic appearance. A detailed account of the pathology and symptomatology is given. The condition is allied to circinate retinitis and to angioid streaks, these being different expressions of the same underlying disease.

Clarence W. Rainey.

Gabriélidès, C. A. **Obesity, polydactyly, retinitis pigmentosa (Laurence-Bardet-Biedl syndrome).** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Oct., p. 887.

A boy aged thirteen years showed a typical retinitis pigmentosa in each eye, adiposo-genital syndrome, and congenital malformation of the left little finger. The rest of the examination was negative. Complete discussion of the syndrome follows. (Bibliography, photographs.) Derrick Vail.

Genet, M. L. **Retinal tears without detachment.** Bull. Soc. Franç. d'Opht., 1936, v. 49, pp. 262-268.

The author discusses five cases in which tears of the retina were observed after trauma by an intraocular foreign body. In no case did detachment of the retina occur. The lips of the tears were adherent to the choroid. The author concludes tears are not the only necessary condition for detachment. Other factors must enter.

Clarence W. Rainey.

Kwaskowski, A. **The data of the Ophthalmologic Institute in Warsaw on the site of the holes in retinal detachment.** Klinika Oczna, 1937, v. 15, pt. 4, p. 381.

From 1933 to 1937 the Institute had 63 patients with retinal detachment. The retinal holes were localized by the geometric method, and by calculating the distance of the hole from the optic disc. In 43 cases the tears were in the equatorial region, 12 to 18 mm. from the limbus. In myopes the majority of the holes were in the superoexternal segment of the retina; in old nonmyopic patients the holes were in the horizontal meridian. In traumatic cases the holes were in various meridians, near the ora serrata. Tears were local-

ized in 37 out of 50 operated cases. In 25 of these 37 cases the opening was closed. There was recovery in 18 and improvement in 7 cases. Of the 13 cases without retinal holes 9 were improved by operation. Ray K. Daily.

Nastri, Francesco. **Researches on dehydrogenating processes of the retina after resection of the optic nerve.** Boll. d'Ocul., 1937, v. 16, June, pp. 617-624.

By experiments performed on rabbits the writer found that the processes of dehydrogenation of the retina in the presence of methylene blue do not undergo variation when the optic nerve is cut behind its blood vessels. Metabolic processes in the retina are affected normally and for a long period of time.

M. Lombardo.

Raadt, O. L. E. de. **Diabetic retinitis. Remarks on the article of the same name by Reinhard Braun** (see Amer. Jour. Ophth., 1937, v. 20, p. 330). Graefe's Arch., 1937, v. 37, pt. 4, p. 648.

In answer to Braun's statement that de Raadt's publications regarding the ammonium theory of retinitis diabetica are so brief that critical consideration is very difficult, de Raadt briefly reviews the essential points in his findings as reported in some twelve published articles. There exists only a difference in degree between the retinal edema of nephritic retinitis and that of diabetic retinitis. Years ago the author had definitely proved that damage to the kidneys in diabetes does not come through chronic secretion of ketone bodies but from very large amounts of ammonium. In the kidneys, the latter is eliminated in the form of an acid. H. D. Lamb.

Radnót, Magda. **The difference between retinal periphlebitis and thromboangiitis obliterans retinae.** Zeit. f. Augenh., 1937, v. 93, Sept., p. 35.

Recurrent juvenile vitreous hemorrhage is widely believed to result from tuberculous retinal periphlebitis. Marchesani thinks that this has not been proved, and that in many cases the fundamental morbid change is thromboangiitis obliterans. Radnót describes in detail the clinical course and histologic findings in five eyes in four of which there was undoubted tuberculous periphlebitis. In these the lumen of the vessels may have been compressed from without by granulation tissue, although there were no changes in the vessel walls. In the fifth eye the media of the vessels were the seat of a lesion of unknown etiology. To supplement this evidence, six patients with recurrent vitreous hemorrhage were reexamined clinically. In three of them tuberculous lesions were demonstrable, and none had signs of thromboangiitis obliterans. The author concludes that the majority of recurrent juvenile vitreous hemorrhages result from tuberculous retinal periphlebitis.

F. Herbert Haessler.

Reichling, W., and Klemens, F. **A vascularized layer of connective tissue between the retinal pigment epithelium and the lamina vitrea.** Graefe's Arch., 1937, v. 137, pt. 4, p. 515.

In normal eyeballs of patients dying from certain diseases, the authors discovered a thin layer of connective tissue containing capillaries between the pigment epithelium of the retina and the lamina vitrea. In cases where development of this membrane was considerable, it extended from the ora serrata posteriorly to the equator of the eyeball and even beyond it. It might not reach the equator and frequently passed only a little behind the equator. Among 18 cases in which the eyeballs removed at autopsy were examined, this membrane

was definitely present in 9. All but two (23 and 33 years) of the nine were over 50 years of age. This membrane was found in all the autopsies on patients over fifty years of age. The cause of death in the two younger individuals was carcinoma of the ovary in one and carcinoma of the stomach in the other. In three of the older cases carcinoma, in two heart trouble, in one diabetes, and in one pneumonia had caused death. In the seven individuals over fifty years of age, deposits of fat were found in this layer of connective tissue and capillaries. The source of this membrane lies in the presence of a matrix, determined by pathologists in the last decade as existing between basal membranes, basal membrane-like cuticula and their covering cell layer. Proliferation of this matrix in the present cases occurred through loosening, histolysis, and organization. This vascularized membrane was frequently found associated with complete or partial disappearance of pigment, or a hyperplasia in the pigment epithelium and local absence of the rods and cones. Cystoid degeneration of the retina was regularly observed in this region. H. D. Lamb.

Rones, Benjamin. **Formation of drusen of the lamina vitrea.** Arch. of Ophth., 1937, v. 18, Sept., pp. 388-402. Also Trans. Sec. on Ophth., Amer. Med. Assoc., 1937, 88th session.

Evidence is given in support of the theory that the hyaline masses are formed from transformation of the pigment epithelium cells instead of being deposited as excrescences, at least in the formation of those drusen occurring in degenerating eyes. The transitional stages from pigment epithelium to drusen are well shown by the illustrations. (Discussion.)

J. Hewitt Judd.

Sallmann, L. **The anatomy of the crossing of blood vessels in the ocular fundus. (Together with a contribution to the pathologic anatomy of Gunn's and Salus' signs).** Graefe's Arch., 1937, v. 137, pt. 4, p. 619.

Observations were made on eyes removed post-mortem from individuals of various ages. These individuals were divided into five groups as follows: Group 1 included 9 persons between 26 and 34 years: group 2, 8 between 41 and 59 years; group 3, 10 between 61 and 76 years. In these first three groups, arterial hypertension was not present. Group 4 included 5 individuals, all with arterial hypertension but without kidney disease. Group 5 included 5 cases of arterial hypertension with contracted kidney. In all 126 vessel crossings were studied. Where the retinal artery and vein at their crossing were only loosely joined by a few connective tissue fibers, it was found that a rigid artery might be able to cause but a slight compression of the vein. Forcing of the retinal vein deep into the retinal layers by a rigid artery did not occur as often in arterial hypertension as in young individuals without cardiovascular disease. Deep compression of the vein with flat arc produced Salus' sign together with loss of transparency in the vessel wall from sclerosis. With a deep compression having a steep descent, the thickening of the wall might cause a short interruption of the vein at the point of crossing. Histologic observations showed that the changes at the vessel crossings in persons of higher ages with arteriosclerosis could not be distinguished from those of patients with high arterial tension. H. D. Lamb.

Schupfer, Francesco. **Concerning some recent works on retinitis pig-**

**mentosa.** Boll. d'Ocul., 1937, v. 16, April, pp. 425-434.

The different theories on pathogenesis of retinitis pigmentosa are mentioned and discussed, together with a review of the most recent works on the subject. The writer concludes and demonstrates that his theory based on congenital degenerative changes of the embryonic layers is the most acceptable. M. Lombardo.

Schupfer, Francesco. **The unilateral form of retinitis pigmentosa.** Boll. d'Ocul., 1937, v. 16, June, pp. 557-587.

In a woman of 55 years the right eye showed the ophthalmoscopic signs of this disorder, together with a corresponding defect of the visual field and light sense. A man of 24 years showed the same symptoms on the left side. General examination of the patients, their skull radiography, carbohydrate and fat metabolism, renal and gastric functional tests, basal metabolism, smell and hearing, and neurologic and psychologic examinations showed that in unilateral retinitis pigmentosa extraocular disturbances exist analogous to those present in bilateral retinitis pigmentosa, and which can be interpreted as of diencephalo-hypophyseal origin. The pathogenesis of the unilateral form, however, cannot be connected with such an origin. Rather the diencephalic disturbances and the retinitis pigmentosa are to be considered as exponents of a congenital degenerative process affecting one or more embryonic layers. (Bibliography.)

M. Lombardo.

Serr, H. **Analysis of the spontaneous appearance of pulsation in the retinal vessels.** Graefe's Arch., 1937, v. 137, pt. 4, p. 487.

A farmer, seventy years old, with no sign of any heart or general disorder and showing a blood pressure of 145/85 mm. Hg, had a normal right eye but a left eye showing simple glaucoma with normal vision and only moderate contraction of the visual field inferonasally. The intraocular tension of the right eye varied between 17 and 22 mm. Hg and that of the left eye without miotics between 36 and 49 mm. After the use of pilocarpin, the intraocular tension diminished to 26 mm. Hg. With the ophthalmoscope, there could be detected in either eye a decided spontaneous pulse of the retinal vein. When the intraocular tension of the left eye was allowed to increase by omission of the miotic, the venous pulse remained unchanged, and furthermore a spontaneous pulse of the retinal artery grew more evident with the increasing ocular tension. With a cinematographic camera, images were obtained for each 1/16 second of the venous and arterial changes in the left eye. Then, for filling and collapse of the retinal artery and vein, curves were plotted for each 1/16 second and were compared to the period of systole and diastole of the heart. The frequency of the heart beat was 88 to 90 in this patient. As graphically depicted in the author's representation, collapse of the pulsating vein on the papilla began immediately or at the most 1/16 second after the pulsating of the retinal artery. Collapse of the retinal vein continued as a rule for 4/16 second or one third of the time (12/16 second in this patient) necessary for a complete cycle of the heart's action. The vein began to fill with blood 4/16 second after the beginning of the arterial pulse, and it remained uninterruptedly filled for 8/16 second or two thirds of the time needed for a complete heart cycle. Collapse of the retinal vein coincided with increase

of intraocular tension, which was synchronous with ventricular systole, whereas filling of the vein was simultaneous with the diminution of intraocular tension dependent upon ventricular diastole. The author concludes that now, after eighty years of discussion, this problem is finally settled.

H. D. Lamb.

Tristaino, Leonardo. **Coats's retinitis.** Rassegna Ital. d'Ottal., 1937, v. 6, May-June, p. 239.

A case of exudative retinitis of Coats, occurring in a 39-year-old woman, is described, and the microscopic findings presented. The literature is carefully reviewed and the various theories of the causation of the clinical picture presented. From study of his case, the author draws the following conclusions: (1) The morbid process is localized above all in the retina, and especially the posterior quadrant. (2) The most significant changes occur in the supporting structures of the retina and are clearly inflammatory, showing proliferating capillaries and perivascular infiltrations. (3) A choroidal transudate or exudate contributes to the detachment of the retina. The subretinal material is of complex structure, with the presence of vacuoles and small vessels which probably arise from the pigment epithelium. (4) While some cases of Coats's disease depend upon an angiomatous basis, the case described proves that the disorder may occur without any such elements. (16 figures.) Eugene M. Blake.

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Halbertsma, K. T. A. **Pseudoatrophy of the optic nerve among the new-born (myelinitic dysgenesis of the optic sheaths).** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Aug., p. 699.

At the age of eight weeks an infant presented the following findings: fixed expression of the eyes, no apparent perception of light, no pupillary reaction to light, and very slight dilatation of the pupils by a mydriatic. The optic-nerve heads were of a pale rose-yellow color, the vessels apparently normal. Three months later the pupils reacted to light and the infant would follow a flash light in all directions. In the center of the optic nerve a whiter color was beginning to appear. In time this became larger until it took on the normal fundus appearance. A diagnosis of pseudoatrophy of the papilla was made. The most likely basis is delay in myelinization of the optic fibers, of unknown origin. Derrick Vail.

Puscariu, Elena. **Retrobulbar neuritis in cases of serous meningitis.** Brit. Jour. Ophth., 1937, v. 21, Nov., pp. 599-604.

The author reports two cases associated with serous meningitis, from ten instances of retrobulbar neuritis observed. The first observation was on a woman of 23 years, the second on a boy aged 19 years. It is the conclusion that serous meningitis should be considered in cases of retrobulbar neuritis, and a lumbar puncture made as being not only of diagnostic value but as having good therapeutic effect on both cerebral and ocular manifestations. (Bibliography.) D. F. Harbridge.

## 12

### VISUAL TRACTS AND CENTERS

Gjessing, H. G. A. **A rare complication following appendectomy.** Arch. of Ophth., 1937, v. 18, Sept., pp. 371-372.

A man aged 54 years collapsed and became extremely cyanotic during an

appendectomy. After the operation it was found that he was totally blind, had oculomotor paralysis and possibly a paralysis of the left abducens, and had paresis of the right arm and leg. He died the following night, and an autopsy was not secured. Narcosis had been induced with Ombrédanne's apparatus, which causes temporary asphyxia. It is probable that during this state rupture of a vessel occurred at some point of diminished resistance in the pons, the resulting hemorrhage affecting both the oculomotor and the visual centers. J. Hewitt Judd.

Puglisi-Durante, Giovanni. **Another case of isolated internal ophthalmoplegia.** Boll. d'Ocul., 1937, v. 16, May, pp. 500-503.

A man of 33 years had been complaining for six months of defective vision, both distant and near, in the right eye. The movements were normal, but the pupils, although round and having normal reactions, were unequal; R. 6.5 mm., L. 3.5 mm. Vision both distant and near became normal with proper lens correction. Both eyes showed retinochoroiditis of the luetic type. The blood Wassermann gave a positive reaction. In discussing the pathogenesis the writer assumes that the condition was due to a radicular lesion of luetic and vascular origin.

M. Lombardo.

## 13

### EYEBALL AND ORBIT

Keller, M. **Note on a new method of treatment of ocular elephantiasis.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Sept., p. 779.

Twelve cases of ocular elephantiasis were treated with novarsenobenzol, with remarkable results. By this procedure one can avoid surgical treatment, which not only is mutilating but does not necessarily lead to a cure. A minimum dose is used; 7 to 15 centigrams in children, 30 to 45 in adults, repeating in 4 or 5 days. (Illustrations.)

Derrick Vail.

Smelser, G. K. **A comparative study of experimental and clinical exophthalmos.** Amer. Jour. Ophth., 1937, v. 20, Dec., pp. 1189-1203.

Wheeler, J. M. **Orbital cyst without epithelial lining, report of two cases of blood cyst.** Arch. of Ophth., 1937, v. 18, Sept., pp. 356-362.

Two cases of blood cyst operated on for unilateral exophthalmos are reported. In one case there apparently had been a fresh hemorrhage into the cyst a few days before the operation, but in the other there apparently had been no bleeding into the cyst for a relatively long time and the contents were green instead of red. No history of trauma was elicited in either case. Removal of the entire wall of the cyst is not necessary if it is cauterized with phenol. Good exposure of the orbital contents can be obtained without an osteoplastic flap by free canthotomy with a continuation of the horizontal incision beyond the orbital margin and with free incisions of the tarso-orbital fascia above and below.

J. Hewitt Judd.

# NEWS ITEMS

Edited by Dr. H. Rommel Hildreth

640 S. Kingshighway, St. Louis

News items should reach the Editor by the twelfth of the month

## Deaths

Dr. Edward Lee Meierhof, New York City, died October 25, 1937, aged 76 years.

Dr. Francis J. Hackney, Chattanooga, Tenn., died October 28, 1937, aged 64 years.

Dr. Elmer Ellsworth Hagler, Springfield, Ill., died October 17, 1937, aged 74 years.

Dr. J. Paul Ernest Bousquet, Montreal, died October 27, 1937, aged 57 years.

## Miscellaneous

The American Physicians' Art Association, a national organization of medical men who have ability in the fine arts, will hold a first national exhibition in the San Francisco Museum of Art, San Francisco, California, in June, 1938. (The American Medical Association Convention is June 13-17 in the same city.) The American Physicians' Art Association already has an outstanding membership. There are three classifications for membership: active, associate, and contributing. The first annual exhibition promises to be of unusual interest with entries to be accepted (after jury selection) in the following classifications: oils, watercolors, sculpture, photography, pastels, etchings, crayon and pen and ink drawings (including cartoons), wood carvings, and book bindings. Scientific medical art work will not be accepted. The exhibition is not limited to first showings. All entries close April 1, 1938. Any physician interested should communicate at once with the Secretary of the American Physicians' Art Association, Suite 521-536 Flood Building, San Francisco, California.

## Societies

The Annual Lectures for 1938 to be delivered under the auspices of the North England Ophthalmological Society were given by Professor Moritz von Rohr of Jena, at the University of Sheffield. January 21st and 22d. The lectures were: On the development of spectacles with special reference to recent improvements in the design of the spectacle lens.

The Montreal Ophthalmological Society presented the following program on December 9, 1937: Dr. Tooke, Massive tuberculoma of the eye; Dr. Badeaux, Bullous keratitis associated with iridocyclitis; Dr. Johnston, Tumors of the bony orbit—two living cases. Dr. MacMillan, Serpiginous ulcer—living cases and microscopic sections. Dr. Ramsey, Demonstration of the effects of eye movements on detachment of the retina; Dr. Rosenbaum, Ectopia lentis.

The Seventh Cruise-Congress of the Pan-American Medical Association took place on the S.S. *Queen of Bermuda*, January 15-31. Visits were made in Cuba, Haiti, the Dominican Republic and Puerto Rico.

The Inter-State Postgraduate Medical Association of North America announces the following 1938 Assemblies: South American Assemblies, March 19th to May 16th; European Assemblies, May 18th to July 17th; International Assembly in Philadelphia, October 31 to November 4 inclusive.

## Personals

Dr. Meyer Wiener and Dr. B. Y. Alvis announce that Dr. Edmund B. Alvis and Dr. Harry D. Rosenbaum are now associated with them in the practice of ophthalmology, Suite 900, Carleton Building, St. Louis, Mo.